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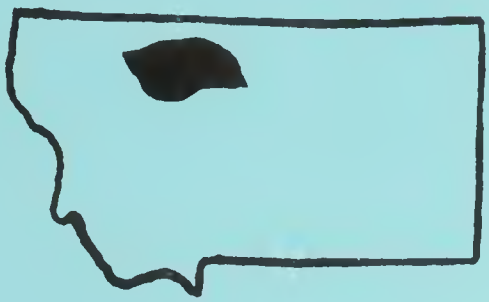
WATER QUALITY INVENTORY AND MANAGEMENT PLAN

MARIAS RIVER BASIN
MONTANA



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WATER QUALITY INVENTORY AND MANAGEMENT PLAN

MARIAS RIVER BASIN, MONTANA

Prepared for
Environmental Protection Agency
Region VIII
Denver, Colorado

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WATER QUALITY INVENTORY AND MANAGEMENT PLAN

MARIAS RIVER BASIN, MONTANA

1. INTRODUCTION

This report presents information relative to water quality management in the Marias River basin (Figure 1). This is one of sixteen basins designated by the State of Montana for preparation of water quality management plans. The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) have directed states to prepare such plans as part of a nation-wide program for controlling water pollution. The objectives of this effort are to provide the State with water quality data and related information to: (1) determine the water quality characteristics of all natural and wastewaters, (2) determine what factors both natural and man-made, affect the quality of waters, (3) develop a management strategy for maintaining and enhancing the quality of waters in the Marias River basin and, (4) provide information needed to determine whether Montana's water quality standards are and will continue to be met. Also included is a description of physical characteristics of the basin. The general methodology used in this study was the compilation and evaluation of existing water quality data and related information. Where information was deficient, field investigations and water and wastewater sampling and analysis were completed to obtain the needed information.

This investigation does not present a detailed analysis of the area's resources; but summarizes water quality related information. As additional information becomes available, the Marias River basin water quality management plan will be revised and updated as part of Montana's continuing planning process.

Assistance in obtaining information for this report was obtained from a number of agencies and persons. The Montana Department of Natural Resources and Conservation provided information on land use, water use, economy and population. United States Geological Survey (USGS) personnel provided unpublished water quality data on stations maintained by the Survey. Weather information was obtained from the United States Department of Commerce Weather Bureau. Montana State University Extension Service provided information on the length of freeze free season.

Thanks are given to residents in the basin that kindly supplied information on the area's resources. Of special note are the contributions of Raymond Tomscheck of Ethridge who was extremely helpful in the investigations of Spring Coulee including the extensive sampling done on January 16, 1974; Mike Clasby and Paul Pacini who were invaluable during many of the field investigations.

Abbreviations and symbols used in this report are defined when first used and defined again in Appendix A.

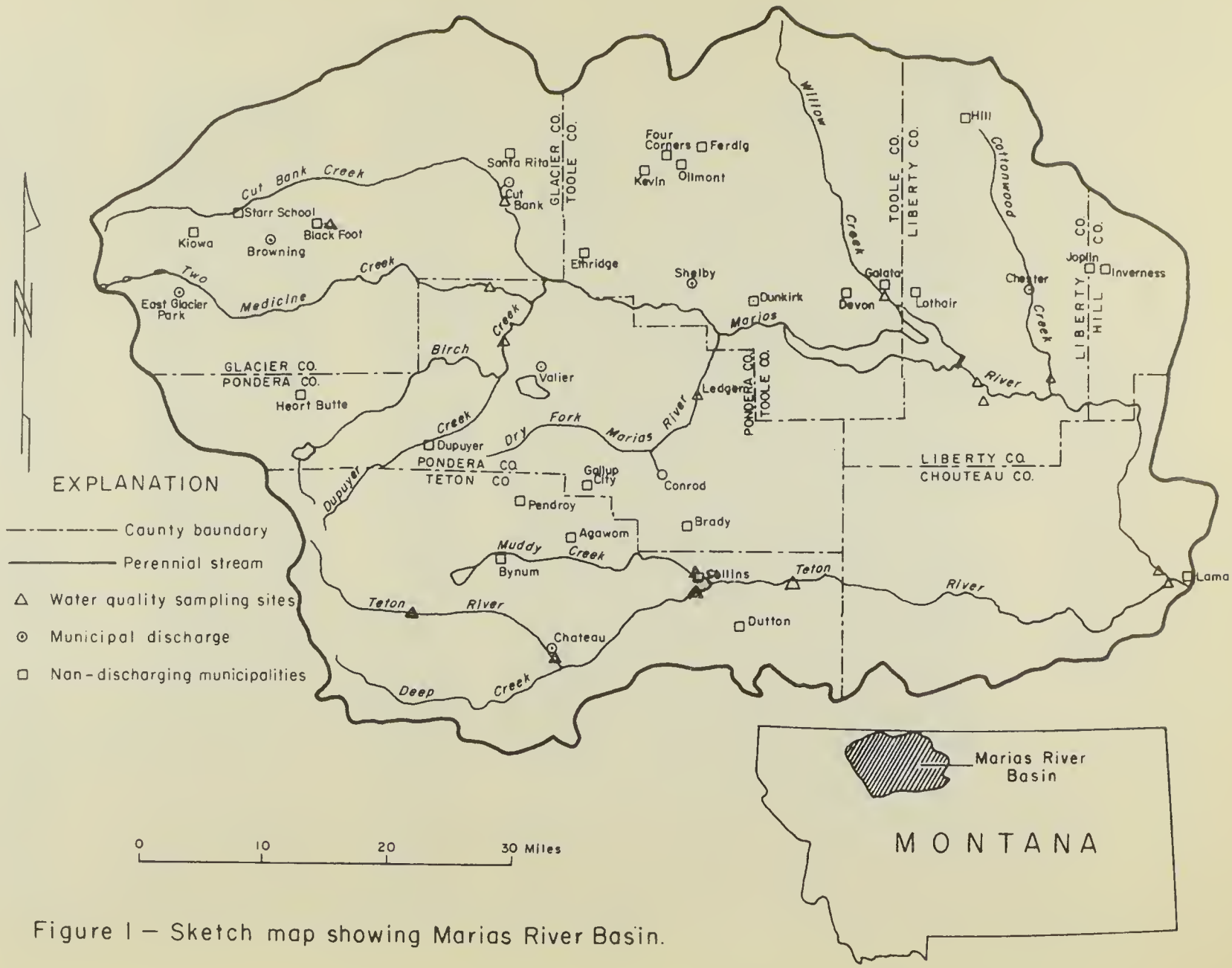


Figure 1 — Sketch map showing Marias River Basin.

II. SUMMARY AND CONCLUSIONS

There are 12 municipal, no known confined livestock, two industrial and an undetermined number of irrigation discharges in the Marias basin. Permits have been issued under the joint state-federal discharge permit system for three of these discharges. Permits for 12 are pending; five of those pending are for potential confined livestock discharges. Compliance schedules have been established for two municipal discharges and no industrial discharges; best practicable treatment is required of industrial dischargers and secondary treatment is required of municipal dischargers by July 1, 1977.

Even with application of best practicable and secondary treatment to industrial and municipal discharges, respectively, all waters in the Marias basin will not meet state water quality standards. The lower Marias will continue to have high temperature and sediment concentrations from natural causes. The lower Teton will continue to have high temperature from natural causes, but aggravated by irrigation dewatering of streams near Choteau. Priest Butte Lake, Alkali Lake, and Hilger Coulee will continue to have total dissolved solids concentrations due to seepage of highly alkaline water into these lakes and streams.

Municipal facilities investments needed to achieve secondary levels of treatment for public sewage treatment facilities are estimated at more than $3,000,000. Construction should begin fairly soon to provide secondary treatment for East Glacier Park and East Glacier Lodge. Most communities in the basin need to upgrade sewage treatment facilities.

A surveillance plan for continued monitoring of water quality in the Marias basin is described in this plan.

III. RELATED INVESTIGATIONS AND PLANS

A report on the Marias River and tributaries (U. S. Army Corps of Engineers, 1973) is basically a water use report that indicates recommended dam sites for flood control and irrigation were economically infeasible. A report of water consumption in north central Montana (Hinningson, Durham and Richardson, 1970) indicates there is not enough water to fully develop the irrigation requirements of the study area.

Limnological effects of Tiber Reservoir on the Marias River were discussed by Quentin J. Stober (1963). Effects of the reservoir upon the river were documented concerning temperature, turbidity and plankton. The feasibility or irrigating land between Tiber Reservoir and Havre as well as augmenting Milk River flow with Marias River water was discussed by the U. S. Bureau of Reclamation (1970). The report was written as an attempt to begin using the water from Tiber Reservoir for its intended purpose.

A survey of water resources of the Cut Bank area (Everett A. Zimmerman, 1967) indicates that groundwaters from the Virgelle Sandstone and the Two Medicine formations and surface water from the Cut Bank Creek are the only dependable sources of freshwater in the study area. Also the depletion of fresh groundwater supplies in the Virgelle is not imminent. A watershed work plan for Browning (Soil Conservation Service, 1973) indicates that construction of four flood retarding structures could reduce erosion and sediment deposition in Willow Creek and reduce 94 percent of Browning's annual flood losses. "Inflow-Outflow and Water Quality of Mission Lake, North-Central Montana" (Leonard R. Frost, Jr., 1973) shows that in using Mission Lake as a storage basin for irrigation water it was necessary to flush the lake of accumulated salts with good quality water from the Two Medicine Canal.

AREAWIDE WASTE TREATMENT MANAGEMENT PLANS

Presently there are no areawide waste treatment management plans (PL 92-500, Section 208) within the Marias drainage basin and none are expected.

SECTION 201 FACILITY PLANS

No wastewater facility plans have been written for any municipalities within the Marias drainage basin. Any sewage construction grants awarded after July 1, 1974 will require, under the present federal grant program, a facility plan to be written by the municipality or their consulting engineers. Therefore, East Glacier is preparing a facility section 201 facility plan.

LEVEL B PLANS AND OTHER FEDERAL PLANS

No level B plans or federal plans have been made for the Marias basin and none are planned for the immediate future.

IV. BASIN PHYSICAL CHARACTERISTICS

The Marias River basin (Figure 1 and Plate 1) is about 140 miles long and 80 miles wide, with its greatest axis lying basically east and west. The basin drains an area of approximately 9,100 square miles; however, 580 square miles are in a dry lake area composed of unconsolidated glacial till. This region has poorly developed drainage, which does not contribute significantly to basic water yields or peak flood flows.

The Marias basin includes all of Pondera County and approximately 57 percent of Glacier County, 85 percent of Toole County, 73 percent of Liberty County, nine percent of Hill County, 27 percent of Chouteau County and 67 percent of Teton County. The basin varies from rugged mountains along the Continental Divide on the west to broad, rolling plains broken by the Knees (Two Buttes) in the south-central part of the basin and by the Sweet Grass Hills in the northern part. The streams flowing through and originating in the plain are located in moderately mature valleys, flanked on either side by bluffs ranging as high as 200 feet. Dominant geographical features include Tiber Reservoir in the east-central portion and the mountains of the west which encompass the southeast part of Glacier National Park. A noticeable peculiarity of the region is the absence of a marked foothill development. There is an abrupt transition from the mountains to the plain stretching to the east.

Most streams west of an imaginary line from Browning to Choteau are perennial as are the headwaters of streams in the Sweet Grass Hills. Major perennial streams in other parts of the basin are Cut Bank Creek, Two Medicine Creek, Birch Creek and the Marias River. If undisturbed by irrigation, the Dry Fork of the Marias River, Pondera Creek, the Teton River, and Dupuyer Creek would also be perennial. All streams flow essentially east and south joining the Missouri River at Loma approximately 20 miles downstream from Fort Benton.

Located in the basin are 12 municipal sanitary waste discharges, 6 municipal storm drain discharges, 3 water treatment plant discharges, 1 oil refinery discharge, 1 meat packing plant discharge, 1 irrigation collection basin discharge, 1 municipal groundwater drain tile discharge and an undetermined number of individual sanitary waste discharges. There are also 14 Water Quality Bureau monitoring stations, 15 USGS water quality monitoring stations, 13 active streamflow gaging stations, 40 inactive streamflow gaging stations and 23 active weather stations located in the basin.

The waters of the Marias basin have been classified by the State of Montana as A-Closed, B-D_1 or B-D_2. A-Closed designates that the quality is to be maintained suitable for drinking, culinary and food processing after simple disinfection. B-D_1 designates that the quality is to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation,

sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. B-D_2 waters are to be maintained essentially the same as B-D_1 waters except that growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers are to be maintained. Detailed criteria for these classifications are given in Montana's Water Quality Standards (Appendix B).

Stream segments of the Marias basin designated as A-Closed are Midvale Creek above the East Glacier water supply intake and Summit Creek above the Summit water supply intake. Stream segments designated as B-D_1 are all of Two Medicine Creek's tributaries except those listed as A-Closed; Two Medicine Creek above the confluence with Badger Creek; all the tributaries to Cut Bank Creek except the Old Maid Coulee Drainage and Willow Creek; all the tributaries to the aforementioned Willow Creek; the aforementioned Willow Creek above Highway 464 crossing near Browning; and the Teton River drainage above and including the Deep Creek drainage near Choteau. The rest of the waters in the basin are classified B-D_2.

CLIMATE

Climate of the Marias basin is characterized by short, hot, dry summers and cold, dry winters. Constant winds affect the winter's chill factor and the lack of summer wind causes the summer heat to be almost overbearing. A large portion of the annual precipitation occurs in the spring. An unusual aspect of the weather is the warm, moist pacific air that is pushed into the basin in the winter. These chinooks cause air temperatures to rise as much as 60°F within a short time and cause rapid snowmelts. Floods frequently occur when the chinook is accompanied by rainfall.

Precipitation in the Marias basin, for the most part, is in the 10-30 inches per year range. The mountains on the west receive possibly as much as 40 inches/year; Summit has a 25-year average of 36.9. As shown on Figure 2 the Marias drainage basin lies within the confines of the 50-135 days frost free growing season. Mean monthly temperatures in the basin are as low as -2°F during January and as high as 83°F in July and is indicated in Figure 3.

Weather stations in the Marias basin are listed in Table 1. The column "Years of Record" shows if the station is active or discontinued. The stations are maintained by various individuals and agencies as well as the Weather Bureau and generally record precipitation and temperature.

TABLE 1. WEATHER STATIONS IN THE MARIAS RIVER BASIN

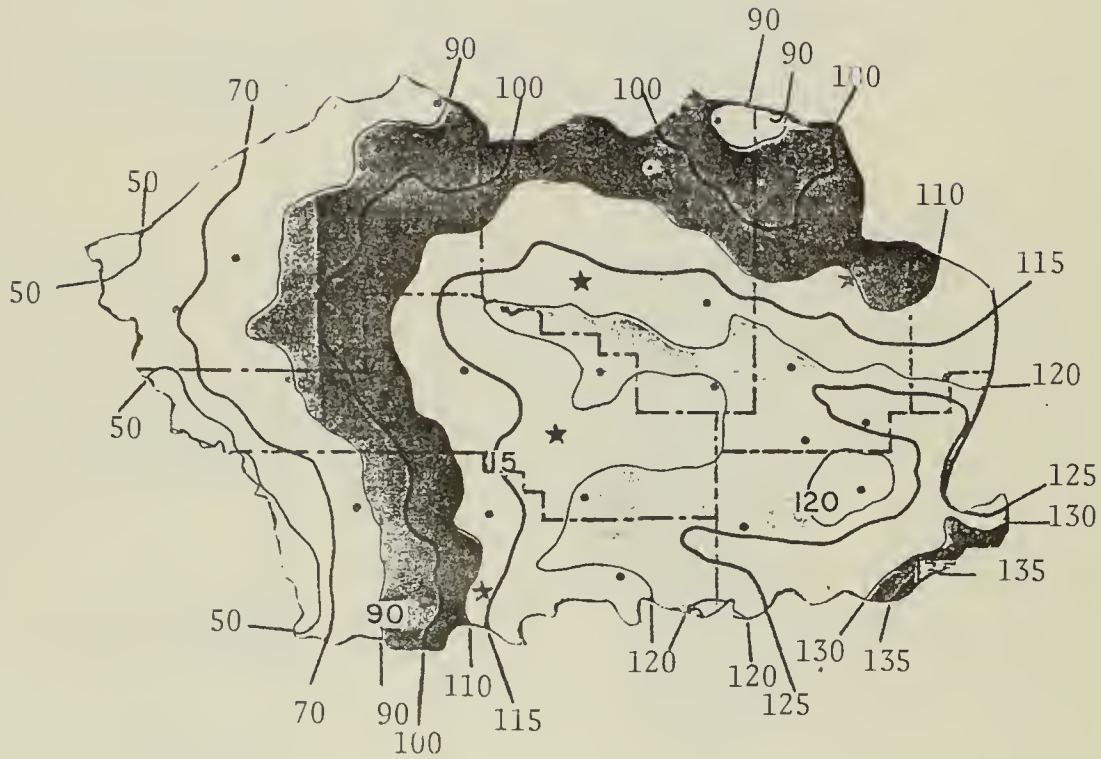
STATION NAME	LOCATION	PRECIPITATION	TEMPERATURE	EVAPORATION	GAGING	YEARS OF RECORD*
Santa Rita 14 N	36N06W12B--	X	X		nonrecording	6 (disc)
Kippen	35N01E15---	X			"	4 (disc)
Dunkirk 14 NNE	34N01E26D--	X	X		"	61
Browning	33N11W03DA-	X	X		recording	79
Seville	33N06W07BC-	X	X		nonrecording	2 (disc)
Cut Bank FAA AP	33N06W22A--	X	X		recording	21
Joplin 1 N	33N07E26DD-	X	X		"	41
Ethridge	32N04W04DA-	X			nonrecording	24
Shelby AP	32N02W22CB-	X	X		recording	34
Chester	32N06E21CA-	X	X		nonrecording	73
Lothair	31N04E04---	X	X		"	30 (disc)
East Glacier	31N12W18---	X			"	24
Badger Creek	30N09W03---		X		"	0.5 (disc)
Lubec	30N13W03D--	X	X		"	3 (disc)
Kinread	30N04E25---	X	X		"	12 (disc)
Rudyard (near)	30N09E26---	X	X		"	7 (disc)
Tiber Dam	30N05E33DC-	X	X	X	"	21
Valier	30N05W33DD-	X	X	X	"	62
Summit	30N14W34D--	X	X		recording	52 (disc)
Tiber Lake	29N06E12CB-	X	X	X	nonrecording	4 (disc)
Heart Butte	29N09W07CC-	X			"	12 (disc)
Galata 16 SSW	29N02E25A--	X			"	24
Dupuyer 7 WNW	29N08W27DA-	X	X		"	6
Dupuyer	28N07W09D--	X			recording	25
Conrad Airport	28N03W22---	X	X		nonrecording	62
Swift Dam	28N10W23D--	X			recording	8
Dupuyer 5 SE	28N06W31BC-	X			"	?
Pendroy 2 NNW	27N06W12C--	X			nonrecording	33
Russell	27N05E26C--	X			recording	21 (disc)
Fort Benton 20 NW	26N06E08B--	X			"	13
Blackleaf	26N06W07C--	X	X		nonrecording	47
Brady Aznoe	25N03E03B--	X	X		"	30
Loma 1 WNW	25N09E12AC-	X	X		"	23
Bynum 4 SSE	25N05W18A--	X			"	24
Carter 10 N	25N06E15C--	X			recording	10 (disc)
Farmington	25N04W13A--	X	X		nonrecording	2 (disc)
Ear Mountain	25N08W33AD-	X			"	3 (disc)
Dutton 6 E	24N01E11---	X			recording	34
Choteau Airport	24N04W19---	X	X		"	80

Note: X in column indicates this data is being collected or has been collected at this station.

* "Disc" indicates the station has been discontinued.

FIGURE 2

AVERAGE LENGTH OF FREEZE FREE SEASON IN DAYS



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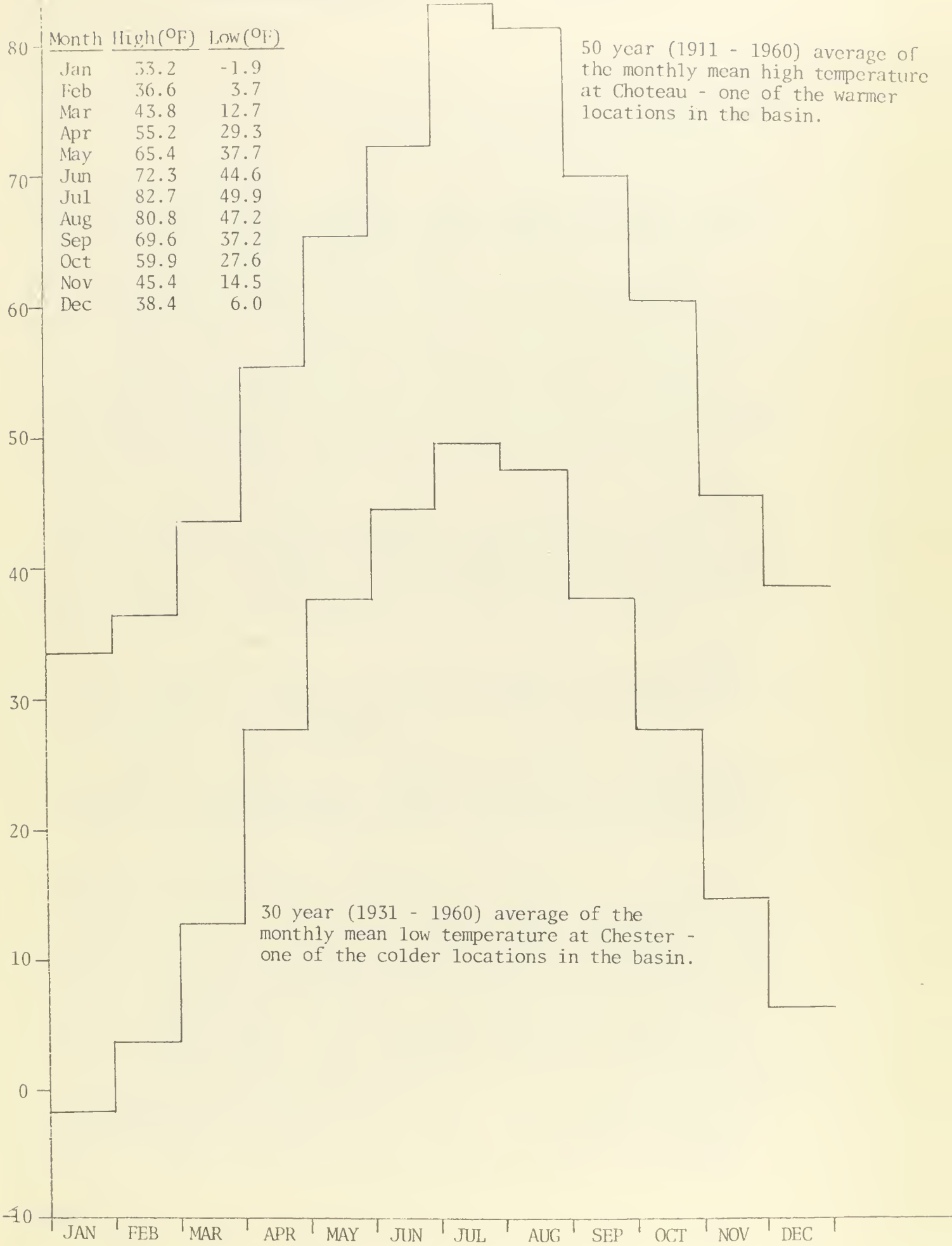
Montana State University, Bozeman, Montana

AVERAGE TEMPERATURE FOR MARIAS RIVER BASIN



Month	High(°F)	Low(°F)
Jan	33.2	-1.9
Feb	36.6	3.7
Mar	43.8	12.7
Apr	55.2	29.3
May	65.4	37.7
Jun	72.3	44.6
Jul	82.7	49.9
Aug	80.8	47.2
Sep	69.6	37.2
Oct	59.9	27.6
Nov	45.4	14.5
Dec	38.4	6.0

HYDROGEOLOGY

Groundwater resources in the Marias River basin are primarily used for stock, domestic, municipal, and irrigation purposes. Water used in the basin is mainly derived from surface water sources; however, groundwater is more widespread and is used by large numbers of people and is a valuable water resource in the basin.

From the rugged mountains in the western portion of the Marias River basin to rolling plains in the central and eastern parts of the basin, there is a wide variety of geological formations ranging in age from Precambrian to Recent. The geological history of the basin includes long periods of sedimentation and erosion and periods of upheaval and deformation that have created the mountains. Glaciation, both local and continental in scale, has changed the landscape and left widespread deposits. Availability and quality of groundwater is greatly influenced by geological conditions in the basin.

Mountains in the western portion of the Marias basin are composed of sedimentary rocks that range in age from Precambrian (greater than six hundred million years old) to Cretaceous (70 to 135 million years old). These rocks have a widely diverse lithology, including limestone, dolomite, sandstone, and shale, and show considerable structural deformation. There has been very little development of groundwater resources in this portion of the basin; however, it is reasonably certain that many of these formations contain groundwater.

Eastward from the mountains is a wide belt of severely faulted and folded rocks primarily of Cretaceous age. Much of this area is covered by material deposited by local glaciers moving eastward from the mountains. There has been little development of groundwater in this area, but it is thought that small to moderate quantities of groundwater can be obtained from wells. Eastward from the mountains are rolling plains that extend to the eastern extremity of the basin. A dominant, geological feature of this portion of the basin is the Sweetgrass Arch. The Sweetgrass Arch is a broad, uplifted portion of the earth's crust that has been eroded in the geologic past. The Sweetgrass Arch was formed by uplift of sedimentary rocks over a broad area extending generally north and south. The central part of the arch cuts through Toole County, the eastern part, and the eastern edge of Pondera County. After uplift, erosion slowly reduced the area to a broad plain. Two important water-bearing formations, the Two Medicine formation and the underlying Virgelle Sandstone, were completely removed over much of the arch. Similarly, much of the Colorado Group which underlies the Virgelle Sandstone was removed. Over broad areas of the eastern and central portions of the Marias basin the Colorado formation remains as the bedrock formation. The Colorado Group is a thick, dark-gray, marine shale that yields little, if any, water to wells.

Bedrock formations in much of the central and eastern portions of the Marias are covered by glacial deposits of Pleistocene age (less than one million years old). A huge continental ice sheet deposited material over most of the eastern and central portions of the Marias basin. Glacial deposits include terminal and ground moraines, outwash channels, and lake sediments. These glacial deposits are as much as 200 feet thick and are composed of dense, compacted mixtures of sand, gravel, silt and clay. These deposits generally yield small amounts of poor quality water to wells.

In addition to continental glacial deposits in the central and eastern portions of the basin, there are a number of glacial deposits derived from glaciers that advanced eastward from the mountains of the western Marias basin. These alpine glaciers covered large areas in the northwestern and southwestern parts of the basin. Deposits from these glaciers are composed of boulders, gravel, silt, sand and clay. There are few wells in these deposits and general geologic conditions suggest that these deposits would yield small to moderate amounts of water to wells.

Scattered terrace deposits of Tertiary or Quaternary age consisting of unconsolidated gravels are found along the mountain fronts. These deposits cover small areas and are remnants of ancient stream deposits. Terrace deposits are as much as one hundred feet thick and generally yield moderate amounts of groundwater to wells and springs.

Along major streams of the basin are small deposits of unconsolidated sand, gravel, silt and clay. These deposits are Recent in age (less than 20,000 years old) and are the result of reworking of older geological deposits. Small to moderate amounts of groundwater can be obtained from these deposits.

Pollution of groundwater is not known to be widespread in the Marias River basin. Sewage stabilization lagoons generally have seepage into the groundwater and create localized areas of groundwater pollution. There have been, however, no reported problems due to lagoon seepage from the 20 sewage lagoons in the basin. The only pollution known from sewage lagoons is seepage from the East Glacier Lodge sewage lagoon into the adjacent Midvale Creek. Septic tank drainfields and subsurface sewage disposal can create groundwater pollution where there are large numbers of septic tanks and individual water supplies using wells. There have been no major problems from septic tank seepage identified within the Marias River basin. Another groundwater pollution in the Marias River basin is saline seeps. Saline seeps originate when groundwater percolates through salt-laden geological materials, thereby dissolving a salt load from these materials and redepositing the salt in areas of groundwater discharge. A number of saline seep problems have been identified in the Marias River basin.

SOILS

The major geologic events that influenced the soils of the Marias River basin were the advance and recession of continental glaciers and glaciers of mountain origin. Continental glaciation influenced the soils in most of the eastern and central sections of the basin. In these areas soils are generally underlain by glacial till which is a nonsorted, nonstratified material carried or deposited by glaciers. Till is largely composed of geological materials of local origin, that is, it strongly reflects the nature of underlying rock. Retreat of glacial ice caused an abundance of water in running streams or in enclosed lake basins. Gravels and sands usually settled near ice margins while silts and clays often were deposited in bodies of still water.

Soils of the rolling and undulating glacial till plains are dominantly loam and clay loams. Typically, they have a loam or clay loam topsoil that is slightly sticky and plastic; a clay loam calcareous subsoil that is hard when dry and sticky and plastic when wet. The topsoil is underlain by till that is hard when dry, sticky and plastic when wet and contains various amounts of mineral salts. Associated with these soils are light-colored (alkali) soils that have hard and massive surfaces. They occur throughout the area in areas of less than one acre to more than 200 acres. Soils of the rolling and undulating glacial till plains can present moderate to severe erosion hazards. They are used primarily for dryland grain production and rangeland.

Soils that have developed in glacial meltwater areas vary considerably. Some are dominated by clay soils and others by fine sandy loams. The better-drained soils have been cropped while the more poorly drained soils are used for range. The bottoms of some glacial lakes and preglacial streams are strongly influenced by alkali salts and present a scabby appearance. They have been utilized as low-productive rangeland. The erosion hazard of these meltwater areas would vary with the cropping practices, intensity of grazing and amount of native vegetative cover.

Mountainous non-glaciated slopes of the Sweet Grass Hills are dominated by stony loams and shallow loamy rocky soils that are generally used for range. Intensity of livestock grazing and amount of native vegetative cover can vary the erosion hazard from moderate to severe.

Along the eastern slopes of the Rocky Mountains, the alpine glaciers pushed down the valleys they helped to create and extended out upon tablelands and valleys leaving glacial deposits. When the advance of these glaciers stopped, the ice melted. The meltwater sorted the glacial deposits forming water-sorted material or outwash. Melting glacial ice caused an abundance of water either in running streams or in basins which formed lakes. The soils of the western section of the Marias River basin have developed on these various glacial materials as well as the old alluvial and sedimentary plains that escaped the direct effects of glaciation.

Soils of the steep, mountainous, forested area in the southwest section of the river basin has moderately deep to very shallow stony soils with rock outcrops of limestone and shale. Elsewhere, the soils of the mountains can vary from shallow stony soils with rock exposures to soils with ashy, grey to black stony loam topsoil underlain by stony clay loam subsoil to soils with a reddish-brown topsoil underlain by a stony clay subsoil. These soils are generally used for watershed protection, wildlife and recreation although some timber harvest operations are being undertaken in the Teton River drainage and on the western edge of the Blackfeet Indian Reservation. These soils could present severe erosion hazards if disturbed due to the steep terrain on which they were formed and their generally heavy texture.

On the rolling and hilly glacial till east of the mountains and the morainal and outwash deposits of the mountain, glaciers have developed cobbly and gravelly soils with varying amounts of intermixed soil material. They are used primarily for livestock grazing and can present a moderate erosion hazard in the presence of overgrazing.

Most of the preglacial plains area has a rough topography and shallow residual soils developed from the early sedimentary formations. Soils formed from the sedimentary calcareous shales are immature and often have the structure and stratifications of parent material. Soils developed on non-calcareous, dark-colored shales have a heavy texture and are underlain by shale at shallow depths. These soils are used primarily for livestock grazing and can present an erosion problem under conditions of disturbance and overgrazing.

Scattered throughout small areas of the river basin are dense clay soils bordering intermittent streams and saline lakes. The soils are sticky and puddle when wet and are hard and crusty when dry.

Major streams are entrenched in shale or sandstone bedrock. Typically the badlands bordering these streams lack vegetative cover. The remainder varies from shallow loamy or clay soils with sparse vegetative cover to pockets of deep soil with good plant cover.

LAND USE

About 62 percent of basin lands are used for pasture and range. Croplands comprise 31 percent of the total area; 2 percent is under irrigation and 29 percent is in dryland farms. The major irrigated crop grown in the area is hay, which is used for summer pasture as well as a winter feed. Wheat, barley and hay are the principal dryland crops grown in the basin with the grain crops dominating. Forest and woodlands occupy the remaining 7 percent of the basin area. These lands are all administered by either the National Forest Service or by private land owners. Lumber production within the basin is insignificant when compared to other economic activities. Oil and

gas production occurs throughout the basin, with the majority of production occurring in Glacier and Toole Counties. There is also limited oil and gas production in Liberty, Pondera, and Teton Counties. The urban area of the basin is negligible as a total of 15,423 people live in the nine largest communities.

WATER USE

The largest man-made water feature located within the study area is Tiber Reservoir with a capacity of 11,368,000 acre-feet. There is a total of 11 reservoirs in the basin with a capacity of 1,000 acre-feet of storage or more. Of these, nine are used for irrigation purposes. These reservoirs have an estimated total surface area of 35,000 acres.

The largest water user in the basin is irrigated agriculture. Annual diversion requirements for irrigation within the basin are approximately 780,500 acre-feet. Of this figure about 191,200 acre-feet is consumptively used and 176,800 is lost in the system. About 412,500 acre-feet of the diverted water returns to the streams as return flows from the various projects. The previous figures are based on a 35 percent farm efficiency and a 70 percent delivery system efficiency.

Municipal water use is estimated at a total of 3,935 acre-feet per year. Of this, 1,751 acre-feet or 44.5 percent is derived from surface sources and the remaining 2,184 acre-feet comes from groundwater sources. Industrial water use within this basin is insignificant.

Water projects in the basin (Table 2) show that there is intensive use of the areas water resources.

TABLE 2. MAJOR WATER PROJECTS IN THE MARIAS BASIN

Name Development	Stream	Agency	Function	Description
Bynum Reservoir	Runoff	Teton Co-op Reservoir Co.	irrigation	Storage 90,000 acre-feet
Blackfeet Indian Irrigation Proj.	Two Medicine Creek, Birch Creek	BIA	irrigation, recreation, flood control	53,094 acres projected. 37,000 acres presently under ditch. 6 diversion dams, 3 storage dams and reservoirs (Two Medicine, Four Horns, and Kipp Lake) 31,000 acre-feet. 522 miles of canals and laterals.
Swift Dam	Birch Creek	Pondera Co. Canal	irrigation	Storage 31,000 acre-feet
Lake Francis	Runoff	Valier Land and Water	irrigation	Storage 112,000 acre-feet
Lower Marias Unit, Marias Division	Marias River	BR	irrigation, flood control, recreation, municipal water supply	Tiber Dam and Reservoir completed and serving recreation, flood control and fish and wildlife purposes. Construction of irrigation features 127,000 acres of land has been deferred. Storage 1,368,157 acre-feet.
Teton Co-op	Teton River	Montana	irrigation	Dam and reservoir with capacity of 4,000 acre-feet.
Theoboe Lake	South Fork Willow Creek	Montana	irrigation	Consists of dam and reservoir with capacity of 830 acre-feet for 500 acres of land.
Farmers Co-op	Teton River	Farmer's Co-op Canal	irrigation	Storage 4,500 acre-feet.
Eureka Reservoir	Teton River	Teton Co-op Canal Co.	irrigation	Storage 5,500 acre-feet.
Brady Lakes	Teton River & Muddy Creek	Brady Irrigation Co.	irrigation	Storage 3,300 acre-feet

DEMOGRAPHY AND ECONOMICS

For this profile, data from county census divisions have been summarized to approximate the population and employment of the basin. According to the 1970 census, about two-thirds of the population is classed as rural. The census classes Cut Bank, Conrad and Shelby as urban.

TABLE 3. MARIAS BASIN - COMMUNITIES OF 100 OR MORE PEOPLE

Community	County	1970 Population
Loma	Chouteau	110
Browning	Glacier	1,700
Cut Bank	Glacier	4,004
East Glacier Park	Glacier	300
Starr School	Glacier	200
Inverness	Hill	170
Chester	Liberty	936
Joplin	Liberty	260
Birch Creek Colony	Pondera	101
Brady	Pondera	250
Conrad	Pondera	2,770
Dupuyer	Pondera	125
Valier	Pondera	651
Choteau	Teton	1,586
Dutton	Teton	415
Miller Colony	Teton	200
Rockport Colony	Teton	116
Kevin	Toole	250
Oilmont	Toole	100
Shelby	Toole	3,100

The basin economy is dominated by agriculture. Irrigation is concentrated in the western foothills and along the river bottoms. The County Water Resources Surveys (Ref. 6-11) have identified nearly 225,000 acres of irrigation in the basin, although it is believed that present irrigation is somewhat less than that. Although some small grains are irrigated, most irrigation is hay. This provides the feed base for the substantial livestock activity. The other major agricultural activity is dryland grain production--predominantly wheat. The basin comprises much of the famed "Golden Triangle" wheat producing area of Montana. Oil and natural gas have been found in several parts of the basin, with the greatest recent production in Glacier and Toole counties.

The table below lists historical and projected population and employment of the basin.

TABLE 4. MARIAS RIVER BASIN, POPULATION AND EMPLOYMENT, HISTORICAL AND PROJECTED 1930 - 1985

	1930	1940	1950	1960	1970	1980	1985
Population	26,768	30,154	30,523	34,901	30,245	31,611	31,544
Employment (Total)	10,648	10,118	11,248	11,453	10,509	10,329	10,146
Agriculture	5,924	4,906	4,640	3,784	2,988		
Forestry & Fisheries	26	9	7	4	8		
Mining & Drilling	529	603	576	367	412		
Construction	335	451	666	573	495		
Manufacturing	376	368	337	368	325		
Services & Other	3,458	3,781	5,022	6,357	6,281		

As can be seen, both population and employment are projected to remain relatively constant.

BIOLOGICAL CONDITIONS

The Marias River drainage contains most of the fish species found east of the Continental Divide. Headwater lakes and streams are inhabited by cold water species such as trout, mountain whitefish and mottled sculpin. Major trout species include rainbow, brook, cutthroat and brown. Grayling are present in a few lakes. Mountain suckers and burbot are found locally throughout the drainage. Some trout, primarily rainbow, are found in the Marias River immediately below Tiber Dam. Other fish species which are found in cold water habitats but which are more tolerant of warm water situations and are found throughout the drainage include northern pike, yellow perch, sauger, walleye, white sucker, longnose sucker and a few species of minnows.

Tiber Dam on the main stem of the Marias River is a barrier to upstream movement of fish. Those fish species found in the drainage below Tiber Dam indicative of warm water habitat include goldeye, channel catfish, bigmouth and smallmouth buffalo, carpsucker, redhorse sucker, blue sucker, drum, and a variety of minnows. Paddlefish and a few pallid

and shovelnose sturgeon are occasionally found in the lower drainage. Channel catfish are also found in the Marias River above Tiber Dam.

Aquatic associated mammals found in the drainage include muskrat, beaver, mink and river otter. Waterfowl dependent on the area for rest stops during migration include the snow goose, canada goose, whistling swan, mallard, pintail, scaup, bufflehead, teal and others. Several of these species also nest in the drainage. Many shorebirds seasonally frequent the area. Some of these include killdeer, yellowlegs, a variety of sandpipers and phalarope. Several species of gulls and terns as well as great blue herons and kingfishers utilize the area during the warmer months. Bald eagles winter along the Marias River below Tiber Dam.

In general, water quality in most of the lakes and streams in the drainage can be considered good. Sediment and warm water temperatures, however, greatly influence fish distribution. Several streams in the drainage undergo a transformation from clear, cool conditions near the headwaters to turbid, warm conditions in their lower reaches during the summer. This condition is probably a natural hydrological pattern but has been aggravated by human activity. Practices contributing to water quality degradation include overgrazing, dewatering, irrigation returns and channel disturbance. Examples of major streams so influenced include the Teton River, Dupuyer Creek and Birch Creek.

A major portion of the Teton River is influenced by human activities. Water from this stream is heavily utilized for agriculture near the town of Choteau. Dewatering, sediment from irrigation returns and overgrazing change this stream from a cold water fishery to a turbid, semi-warm condition in a relatively short distance during the summer. Periodic drainage of highly alkaline water from Priest Butte Lake into the Teton River below Choteau also has some impact on water quality of the river.

Aquatic macroinvertebrates found throughout the length of the Teton River are predominantly pollution sensitive forms. Most of the sensitive organisms are Ephemeroptera (mayflies), however, they undergo a speciation change from the upper to the lower river. Most of the mayflies present in the lower half of the river are mud and sand burrowing forms, which is indicative of the habitat. The primary fish species usually found in the transition are undesirable forms such as suckers.

Other practices contributing to water quality degradation and affecting aquatic life in the drainage includes nutrient enrichment from sewage treatment facilities, irrigation returns and drainage from farm lots, oil contamination, and possibly saline seeps. Some pothole lakes near Cut Bank are subject to oil seeps from drill holes and drainage from pumping facilities. Waterfowl are susceptible to oil contamination in this area. A great potential for water quality degradation and damage to aquatic life exists from saline seeps. At the present, it is unknown if saline seeps are a problem to aquatic life in the drainage.

V. MONTANA WATER POLLUTION CONTROL PROGRAM

Water quality management planning is part of a broad comprehensive water pollution control program administered by the Water Quality Bureau of the Environmental Sciences Division. This program is described in the program plan of the Water Quality Bureau (1974). Important elements of the state program are:

1. State and federal waste discharge permit program
2. Water quality standards
3. Facilities construction grants, plan review, operation and maintenance inspections, training and licensing of operators
4. Statewide monitoring and surveillance program
5. Public participation
6. Enforcement.

STATE AND FEDERAL WASTE DISCHARGE PERMIT PROGRAM

The 1955 Montana state law established a waste discharge permit program. A revision of this law in 1967 required a permit for all discharges. Regulations and a formal state permit program were established in 1968 for the discharge of sanitary sewage and municipal wastes to waters of the state. In 1972, a waste discharge permit regulation for confined livestock feeding was adopted by the Board of Health and Environmental Sciences. All operations feeding livestock for marketing purposes within any confined area or enclosure not normally used for raising crops or for pasture, which at any time discharges drainage water to a state water, is required to have a permit. Existing operations were required to have a permit before June 24, 1974. All new or expanding operations are required to have a permit.

The Federal Water Pollution Control Act Amendments of 1972 established a national permit system. Industrial, municipal, and other point source discharges will be required to obtain permits to discharge pollutants into navigable waters or their tributaries. The EPA (U. S. Environmental Protection Agency) has given authority to allow states to administer the permit program providing the states conform to certain guidelines. On June 11, 1974, Montana assumed most of the federal permit program.

Waste discharge permits are an effective tool for regulating discharge of potentially harmful effluents into Montana lakes and streams. Treatment works will be required to meet specific effluent standards. In most instances, the discharger will be responsible for certain monitoring information; for example, sampling and analysis of the water at specified intervals. In instances where effluent being discharged does not meet state standards, the permit is issued on a "compliance" basis with stipulations as to what corrections will be made and when.

The act also provides that the permit program will achieve, not later than July 1, 1977, effluent limitations for point sources, other than publicly owned treatment works, which shall require the application of best practicable control technology. For publicly owned treatment works, secondary treatment of wastes will be required by July 1, 1977. The act further specifies that by July 1, 1983, effluent limitations for point sources, other than publicly owned treatment works, shall require application of the best available technology. Publicly owned treatment works shall achieve best practicable treatment by July 1, 1987.

These steps will result in progress toward a national goal of eliminating the discharge of all pollutants by 1985.

WATER QUALITY STANDARDS

Water pollution control was started officially in Montana in 1907 with the passage of legislation designed to protect domestic water supplies. A law passed in 1955 was more comprehensive. It dealt with the control and protection of water for additional uses--recreation, agriculture and industry. The law also established a Water Pollution Control Council and charged it with the tasks of classifying all streams in the state according to their most beneficial uses and establishing water quality criteria for the streams. It also involved upgrading the treatment of wastes going into the streams. Montana, thus, became one of the first states to have enforceable stream classifications.

In 1965, the U. S. Congress passed the Federal Water Quality Act, which required that all states classify and establish water quality criteria for their interstate streams by July 1, 1967. This resulted in Montana revising its standards for both interstate and intrastate waters and required a higher degree of stream quality than before. Secondary treatment or the equivalent was required of municipal and industrial discharges. Primary treatment or the equivalent was required before passage of the act.

In October, 1972, the Federal Water Pollution Control Act Amendments were passed by Congress expanding the authority of the Environmental Protection Agency. Uniform water quality standards and enforcement procedures throughout the United States is the objective. For example, industrial waste dischargers throughout the nation manufacturing the same product will have uniform discharge requirements based on the amount of product produced. Again, Montana was required to revise its water quality standards. The Department of Health and Environmental Sciences adopted revised standards on July 13, 1973. The new standards became effective in November, 1973.

Montana water quality standards serve as a functional tool in protecting water quality; however, there are a number of laws, statutes and regulations which complement the water quality standards and significantly assist in protecting water quality.

STATEWIDE MONITORING AND SURVEILLANCE PROGRAM

Prior to 1972, Montana had done little monitoring due to lack of funds. With increased appropriations provided by the 1971 legislature and the federal government, the state greatly increased its efforts. Staff were added and laboratory equipment purchased. The present state monitoring program includes periodic compliance monitoring of municipal and industrial wastes, long-term base line monitoring of streams, and a statewide program for determining the general quality of all significant surface waters.

The statewide inventory of water quality will identify areas with water quality problems and will provide basic data for water quality management and planning programs. Included in the monitoring is a statewide assessment of the trophic (pollution level) status of Montana's lakes, reservoirs and ponds. This program is coordinated with the EPA National Eutrophication Survey.

FACILITIES CONSTRUCTION, OPERATION AND MAINTENANCE

A minimum requirement of primary treatment for all domestic sewage was first adopted by the Montana Board of Health in 1952. All of Montana's communities have met this requirement, and many of the communities are upgrading their facilities to secondary treatment or are in the process of constructing or planning secondary systems. Since 1956, there has been a federal grant program to assist municipalities in the construction of sewage treatment facilities, including outfall and interceptor sewers. In 1971, the Montana state legislature appropriated $4,000,000 to aid municipalities in construction of these same facilities. The 1973 legislature appropriated $1,600,000 to reimburse municipalities that had proceeded with construction since July 1, 1966 without waiting for state grants. With passage of the Federal Water Pollution Control Act Amendments of 1972, 75 percent of eligible project costs are federally financed. Due to a shortage of federal grant funds, a priority system for fund allocation must be used. The state, under EPA guidance, establishes priorities for proposed waste treatment projects.

An important part of municipal sewage treatment is proper operation and maintenance of facilities after construction is completed. In an effort to improve operation and maintenance, the state has conducted an operators' school each year. During recent years, this school has had about 100 operators attending. In 1971, a grant was obtained from the federal government for employing two training instructors to establish training programs throughout the state in addition to the annual school.

An operators certification program was established in 1968 following enactment of a law requiring certification of those in responsible charge of a sewage treatment or industrial waste treatment system.

PUBLIC PARTICIPATION

Public participation in water pollution control is an increasingly important aspect of the state program. Public hearings are held concerning proposed regulations, water quality management plans, and waste discharge permit applications. The state also has an environmental impact statement requirement. These statements are presented to the public for comment, and hearings are conducted on highly controversial issues.

The public is also kept informed by means of a Water Pollution Control Advisory Council, which has been established by law to assist the Water Quality Bureau in preparation of rules and regulations and in dissemination of information to interested groups. Similarly, public meetings are attended on request, and a bi-monthly newsletter is published by the Water Quality Bureau.

ENFORCEMENT

The 1955 Montana state law provided enforcement procedures. These laws were revised in 1971 to provide better enforcement, and an attorney was added to the staff of the Department of Health and Environmental Sciences to aid in enforcement. The state permit system provides a primary means for enforcement. Violators of permit conditions or discharges without a permit can lead to enforcement.

VI. WATER POLLUTION SOURCES

In the Marias River basin water pollution may result from a number of activities, many of which are point discharges. In the basin there are 19 sewage collection systems, 12 of which have a discharge from the associated sewage treatment facility. Five of these discharges have no continuous effect upon surface waters as they discharge to a dry coulee or have a seasonal discharge. Three water treatment plant discharges are located in the basin, all of which probably discharge into streams. Five industrial waste treatment facilities are located in the basin, one of which has a discharge to a dry coulee; another discharges to a city sewer. Four communities have storm drains which discharge to streams. Nine known facilities for waste collection from confined livestock operations are in the basin. None of these facilities discharge. Characteristics of all known point discharges or potential point discharges are summarized in Table 5.

MUNICIPAL FACILITIES

Blackfoot Boarding Dormitory

The Blackfoot Boarding Dormitory is served by a three cell sewage lagoon which reportedly has never discharged. The area of the cells is 0.6 acres, 0.6 acres and 1.2 acres for a total of 2.4 acres. The lagoon serves a maximum of 180 people during school sessions. Should a discharge occur, it would flow into a tributary of Cut Bank Creek. Infiltration is a major problem at this site. If the 1.2 acre seepage cell were sealed (the seal broke in 1964) the lagoon would have a continuous discharge. The 1.2 acre cell needs to be sealed and infiltration eliminated before adequate treatment can be obtained.

Brady

The town of Brady is served by a single cell sewage lagoon which has an intermittent winter discharge to a tributary of South Pondera Coulee. The addition of another cell should make this a zero discharge facility. The lagoon area is 2.75 acres and it serves 250 people.

Browning

The city of Browning is served by a three cell lagoon with a continuous discharge to Depot Creek. The cells have an area of 8.56 acres, 4.94 acres and 8 acres for a total of 21.5 acres. A fourth cell of 10 acres is being planned by the U. S. Public Health Service for the near future. This cell will increase the total lagoon area to 31.5 acres and should provide secondary treatment for 3,150 people. Currently, the lagoon serves approximately 2,400 people. Infiltration is a major problem at this site, especially during spring runoff. Much of the town has a clay pipe collection line.

Browning Industrial Park

The Browning Industrial Park is served by a two cell lagoon having a total area of five acres. The facility is designed for zero discharge,

but should a discharge occur, it would flow into a tributary of Depot Creek. As of this writing, no discharge has occurred. A meat packing plant in the Industrial Park has a single cell anaerobic lagoon for the collection of blood and floor washings. This lagoon discharges to the two cell lagoon (Racine, 1974).

Chester

Chester is served by a 9-acre, single cell sewage lagoon that has a continuous discharge to Cottonwood Creek. Since Cottonwood Creek rarely flows, the discharge impact is difficult to determine. The community had a population decrease from 1960 to 1970. The lagoon needs to be upgraded to provide secondary treatment. Municipal storm water enters Cottonwood Creek about 50 yards above the sewage discharge and constitutes the only observed creek flow other than lagoon effluent.

Choteau

Choteau is served by a 30-acre, single cell lagoon having a continuous discharge to a ditch that discharges to the Teton River. The system serves 1,600 people and needs to be upgraded to provide secondary treatment. Due to excessive infiltration into the sewage system, detention time in the lagoon is low, possibly as low as 70 days. Choteau's population decreased 19 percent from 1960 to 1970.

Conrad

The city of Conrad is served by a three cell, facultative sewage lagoon that has a continuous discharge to Little Dry Coulee, a tributary of the Dry Fork of the Marias River. The cells have a surface area of 10, 9.3 and 3.7 acres for a total area of 23 acres. The 3.7 acre cell receives raw sewage and is equipped with an aerator. The aerated cell was put into operation in 1973.

Cut Bank

Cut Bank is served by a two cell-lagoon that has a continuous discharge to Old Maid Coulee. The cells are 24 and 18.8 acres in area and need to be upgraded to provide secondary treatment. Three lift pumps bring most of the sewage from the old imhoff tank location to the lagoons. The sewage collection system needs to be extended.

Dutton

The town of Dutton is served by two 2.5-acre sewage lagoons for a total area of five acres. The town's population is 415, so the lagoon size should be adequate; however, severe odor problems were experienced in the spring of 1974. This problem was probably due to operational difficulties, but may be due to the high sulphate concentration in the town's drinking water. If the odors become an annual problem they can be reduced by providing mechanical aeration to the first cell. The

lagoon is designed for no discharge; however, should a discharge occur, it would affect surface waters only during spring runoff. Normally a discharge would enter a dry coulee and collect in a stock pond three miles downstream from the lagoon. The stock pond is adequate to contain the waste flow.

East Glacier Lodge

This summer use facility is served by a 250,000 gallon septic tank followed by a leaky, one-acre lagoon. Discharge from the lagoon is by seepage to Midvale Creek, a situation that causes odors. The system is inadequate and action to correct it has been initiated in conjunction with the town of East Glacier.

East Glacier

The town of East Glacier is served by a septic tank which discharges to a tributary of Midvale Creek. Treatment is completely inadequate and will soon be replaced with a system that combines the sewage of East Glacier with that of the East Glacier Lodge. The new system will use non-discharging lagoons.

Inverness

The town of Inverness is served by a two cell sewage lagoon located approximately 1/2 mile east of town. Each cell has a one-acre surface area and can be operated in series or in parallel. Since the town's population is 170, this facility should provide satisfactory treatment. The lagoon does not have a discharge structure; the proposed method of effluent disposal is irrigation of a small feed grain or legume hay field (Ref. 4).

Joplin

The town of Joplin is served by a two cell sewage lagoon located approximately 3/4 mile south of town. Each cell has 1.77 acres of surface area for a total area of 3.54 acres. Since the town has 260 residents, treatment should be satisfactory. Discharge is intermittent to Black Coulee (a stream that is normally dry). The only needs at this facility are a method of effluent disposal other than discharge to the coulee.

Kevin

The town of Kevin is served by a two cell sewage lagoon located in the dry lake bed east of town. Each cell has an area of two acres for a total area of four acres which serves 250 people. The western cell is equipped with an aerator. A discharge has never been observed from the lagoon. The Big West Oil Refinery in Kevin occasionally pumps from the eastern cell to the refinery for cooling water.

Laststar

This development, 3/4 miles north of Browning, is served by a single cell sewage lagoon with 3.4 acres of surface area. This facility has never had a discharge as it is unable to hold water; however, should the lagoon be sealed, a seepage bed is available for a discharge. Presently, 250 people are served by the lagoon.

Tiber Dam Camp

Tiber Dam Camp is served by an imhoff tank followed by a sand filter. Effluent from the filter has been collected and discharged to the Marias River until 1974 when the pipe from the filter was removed. When first constructed, the facility served up to 350 people, but currently serves one family. Population at the site is subject to sharp fluctuations depending upon work being done on the dam. Two projects have been approved for the dam that could affect the population in the next 20 to 40 years. Should one of these projects begin, major alterations of the present sewage treatment will be required.

Shelby

Shelby is served by a three-cell lagoon located southeast of town. The cells have areas of 11.56, 12.55 and 18.14 acres. They serve 3,111 people and receive industrial wastes from a meat packing company and a soft drink bottling company. The lagoon needs to be upgraded to provide secondary treatment and collection system extensions are needed. Lagoon discharge into Medicine Rock Coulee is regulated by the operator.

Starr School Community

The community of Starr School is served by a single cell sewage lagoon located approximately 0.6 miles northeast from the community. The surface area of the lagoon is 2.3 acres and serves 57 residences or approximately 200 people. The lagoon is not sealed and has therefore had no overflow discharge. Once sealed, the lagoon would discharge to Cut Bank Creek.

Valier

Valier is served by a single cell lagoon located 1/4 mile northeast of town. The lagoon has a surface area of 10.7 acres and serves 650 people. The lagoon needs to be upgraded to provide secondary treatment. Lagoon discharge is to a small tributary of Bullhead Creek.

INDUSTRIAL FACILITIES

There are five known industrial facilities in the basin. They are two meat packing plants, two oil refineries and one industrial park-meat packing plant combined. They are in Browning, Cut Bank, Kevin, Shelby, and Choteau.

Browning Industrial Park

This facility includes sanitary wastes and therefore is discussed under municipal facilities.

Marias Packing

Liquid wastes from the Marias Meat Packing Plant are discharged directly to the Shelby sewer system (Nelson, 1974). Discussion of the Shelby sewage treatment facility is in municipal facilities.

Big West

Big West Oil Refinery in Kevin uses water for boiler feed water to drive pumps for the thermocracking unit, for heating the plant and offices and to aid in the fractionation process. Much of this water is recycled in a closed system or lost as steam. Other water is brought from the Kevin sewage lagoon for cooling water. This water is recycled through a holding pond. This pond has no discharge or discharge structure.

Triangle Packing

Liquid waste from the Triangle Packing Plant in Choteau is collected in a two cell anaerobic lagoon. Discharge from the lagoon is regulated by a valve between the lagoon and a high groundwater area. Discharge from this area into the Teton River is prevented by naturally high ground north of the damp area and a road fill to the east (Hoyt, 1974).

Westco

The Westco Oil Refinery east of Cut Bank produces gasoline, diesel and heavy burner fuel with a fractionation process. Cooling water and boiler blowdown water is collected in a two cell lagoon located east of the plant. The total lagoon area is approximately five acres. The lagoons have a continuous discharge to Spring Coulee, but the discharge never reaches a perennial stream.

AGRICULTURAL FACILITIES

A variety of agricultural wastes are present in the Marias basin including irrigation return flows, animal wastes, runoff from range and cultivated lands and from land treated with pesticides, herbicides and fertilizers. Although there are a number of potential water quality problems due to agriculture, high sediment yields in Two Medicine Creek, Birch Creek, Shultz Coulee, Pondera Creek and Muddy Creek are the only problems definitely identified in this report. Other water quality problems that may be related to agriculture but which will require more investigation to determine the source are high total coliform concentrations in Shultz Coulee and Pondera

Creek; high fecal coliform concentrations in Shultz Coulee, Pondera Creek and Deep Creek; high nitrates in the Marias River, Cut Bank Creek, Depot Creek, Birch Creek, Blacktail Creek, Teton River, Muddy Creek, Spring Coulee (near Choteau), Deep Creek and Willow Creek (near Choteau); and high phosphates in Cut Bank Creek, Willow Creek (near Browning), Birch Creek, Two Medicine Creek, Teton River and Willow Creek (near Choteau). High nitrates and phosphates in the Dry Fork Marias River may be related in part to agriculture but the majority is probably from the Conrad sewage discharge.

Agricultural pollution is transient in both time and space and is complex due to the variability of agricultural practices. The effect of agricultural wastes on water quality generally is difficult to determine without long term studies. Future water quality monitoring and additional basin investigations will assist in quantification of agriculture's role in water quality. Several agricultural waste collection facilities are in the basin.

Fred Bergstrom, Brady

Mr. Bergstrom has a 1,200 head indoor swine operation. Waste from the animals is contained in liquid manure pits that are designed to store in excess of 120 days waste production. A discharge should not occur from this facility. Final disposal of the waste material is by application to agricultural land.

Russell Johnson, Cut Bank

Mr. Johnson has a 1,500 head indoor swine operation. Waste from the animals is contained in liquid manure pits that are designed to store in excess of 120 days waste production. A discharge should not occur from this facility. Final disposal of the waste material is by application to agricultural land.

Montana Sainfoin Feeders, Inc., Conrad

This operation is an outdoor confined beef feeding operation for 1,500 head. A potential waste discharge due to overland flow is contained in a holding pond designed to contain a 10-year, 24-hour storm. Should a more severe storm occur discharge would be to Hilger Coulee.

Spike D Cattle Co., Shelby

This is an outdoor confined beef feeding operation for 1,000 head. A potential waste discharge due to overland flow is contained in a holding pond designed to contain a 10-year, 24-hour storm. Should a more severe storm occur, discharge would be to Medicine Rock Coulee.

New Rockport Colony, Choteau

This colony has a 2,500 head indoor swine operation. Waste from the animals is contained in a 1.5 million gallon holding pond. It has not been determined if this volume is adequate for 120 days storage.

Glacier Colony, Santa Rita

This colony has a 1,500 head indoor swine operation. Waste from the animals is contained in a liquid manure pit with final disposal by application to agricultural land. An assessment of the holding capacity of manure pit has not been made.

Glendale Colony, Santa Rita

This colony has an indoor swine operation, the wastes from which are collected in a liquid manure pit. Final disposal is by application to agricultural land. An assessment of the holding capacity of the manure pit has not been made.

Rockport Colony, Pendroy

This colony has 2,400 head indoor confined swine operation. Waste from the animals is contained in a liquid manure pit with final disposal by application to agricultural land. An assessment of the holding capacity of the manure pit has not been made.

The colony also operates a slaughterhouse which has a direct discharge to the South Fork Dry Fork Marias River. The facility kills up to six cattle and 2,500 chickens at one time.

Northern Montana Feeders, Choteau

This is an outdoor confined beef operation. Most liquid wastes from the facility are collected in a perforated pipe subsurface drain and routed to a two cell lagoon. It is doubtful that significant overland flow is contained by this system.

TABLE 5. CHARACTERISTICS OF SIGNIFICANT WATER POLLUTION POINT SOURCE DISCHARGES OR POTENTIAL DISCHARGES

Waste Source and Location[1]	Treatment Type	Receiving Water	Discharge Type	Date Sampled	Discharge Characteristics (units are mg/l unless otherwise shown)
Blackfoot Boarding Dormitory (33N10W07CAB)	lagoon	Cut Bank Cr	intermittent	Feb. 13, 1974	Flow ---------- 0.0 cfs
Brady (27N02W34DDC)	lagoon	S. Pondera Coulee	intermittent	Feb. 14, 1974	Flow ---------- 0.0 cfs
Browning (32N11W11ABD)	lagoon	Depot Creek	continuous	Feb. 14, 1974	Flow---------- 150 gpm pH ---------- 7.8 S.U. BOD_5 ---------- > 48 TSS ---------- 1 Fecal Coliforms--990,000/100 ml
Browning Industrial Park (32N11W15CAA)	lagoon	Depot Creek	intermittent	Feb. 13, 1974	Flow ---------- 0.0 cfs
Chester (32N06E29ACC)	lagoon	Cottonwood Cr	continuous	Sept. 20, 1973	Flow ---------- 15 gpm pH ----------9.1 S.U. BOD_5 ---------- 12 TSS ---------- 96 Total Coliforms---55,000/100 ml
Choteau (24N05W36AAD)	lagoon	Teton River	continuous	Jan. 17, 1974	Flow ----------500 gpm pH ---------- 7.8 BOD_5 ---------- 28.8 TSS ---------- 6.6 Fecal Coliforms---11,600/100 ml
Conrad (28N03W01DBD)	lagoon	Little Dry Coulee	continuous	March 7, 1974	Flow ----------170 gpm pH ---------- 8.1 S.U. BOD_5 ---------- 17 TSS ---------- 62 Total NH_3 ---------- 9.0 Fecal Coliforms -- < 200/100 ml Fecal Strep-------- < 200/100 ml

Waste Source and Location[1]	Treatment Type	Receiving Water	Discharge Type	Date Sampled	Discharge Characteristics (units are mg/l unless otherwise shown)
Cut Bank (33N05W06ACD)	lagoon	Old Maid Coulee	continuous	Jan. 17, 1974	Flow ---------- 60 gpm pH ---------- 7.1 S.U. BOD_5 ---------- 6.8 TSS ---------- 2 Fecal Coliforms ---- 533/100 ml Total Coliforms ---5,200/100 ml
Dutton (24N01W11BDD)	lagoon	Hunt Coulee	intermittent	Feb. 14, 1974	Flow ---------- 20 gpm pH ---------- 7.9 BOD_5 ---------- 101 TSS ---------- 16 Fecal Coliforms---67,000/100 ml Total Coliforms--530,000/100 ml
E. Glacier Lodge (31N12W18C__)	lagoon	groundwater to Midvale Cr	seasonal	Sept. 5, 1973	Flow ----not determined, sample from groundwater BOD_5 ---------- <6 Fecal Coliforms ----- 49/100 ml Total Coliforms ----- 49/100 ml
East Glacier (31N12W10BAA)	septic tank	tributary to Midvale Cr	continuous	May 16, 1974	Flow ---------- 22 gpm BOD_5 ---------- <48 TOC ---------- 25 Fecal Coliforms--440,000/100 ml
Inverness (32N08E03___)	lagoon	East Fork Black Coulee	never	Feb. 27, 1974	Flow ---------- 0.0 cfs
Joplin (32N07E12BDA)	lagoon	East Fork Black Coulee	intermittent	Feb. 18, 1974	TSS ---------- 26 pH ----------7.8 S.U.
Kevin (35N03W35CAC)	lagoon	Shelby Coulee Drainage	never	Dec. 5, 1973	Flow ---------- 0.0 cfs
Laststar (33N11W35DBC)	lagoon	Flatiron Cr	never	Feb. 13, 1974	Flow ---------- 0.0 cfs

Waste Source and Location[1]	Treatment Type	Receiving Water	Discharge Type	Date Sampled	Discharge Characteristics (units are mg/l unless otherwise shown)
Shelby (32N02W35CDC)	lagoon	Medicine Rock Creek	regulated	Feb. 28, 1974	Flow ---------- 150 gpm pH ---------- 7.5 BOD_5 ---------- 39 TSS ----------2 Fecal Coliforms -- 1,600/100 ml Fecal Strep ------20,000/100 ml
Starr School (33N12W25B--)	lagoon	Cut Bank Cr	never	Feb. 13, 1974	Flow ---------- 0.0 cfs
Tiber Dam Camp (29N05E04AAA)	imhoff tank	Marias River	never	Feb. 27, 1974	Flow ---------- 0.0 cfs
Valier (30N05W34---)	lagoon	tributary of Bullhead Cr	intermittent	Oct. 25, 1973	Flow ---------- 50 gpm BOD_5 ---------- $\geq$ 12 Total Coliforms---79,000/100 ml
Birch Cr Col.[2] (29N07W26A--)	none	Leech Ditch	continuous	not sampled	----------
Glendale Col.[2] (36N07WDCD)	none	dry tributary to Rocky Coulee	continuous	not sampled	----------
New Rockport Col[2] (24N03W05---)	none	dry tributary to Teton River	continuous	not sampled	----------
Glendale Col.[3] (36N07WDCD)	none	dry tributary to Rocky Coulee	intermittent	not sampled	----------
Rockport Colony[2] (27N07W26CAC)	none	dry tributary	continuous	not sampled	----------
Rockport Colony[3] (27N07W26CAC)	none	S. Fk. Dry Fk. Marias River	intermittent	not sampled	----------
Browning[4] (32N11W02B--)	none	Willow Creek	intermittent	not sampled	----------

Waste Source and Location[1]	Treatment Type	Receiving Water	Discharge Type	Date Sampled	Discharge Characteristics (units are mg/l unless otherwise shown)
Conrad[4] - 001 (28N03W13BCB)	none	Little Dry Coulee	intermittent	not sampled	----------
Conrad[4] - 002 (28N03W23DBC)	none	Pondera Coulee	intermittent	not sampled	----------
Conrad[4] - 003 (28N03W23CAD)	none	Pondera Coulee	intermittent	not sampled	----------
Cut Bank[4] - 001 (33N06W01CCB)	none	Cut Bank Cr	intermittent	not sampled	----------
Cut Bank[4] - 002 (33N06W12CDD)	none	Cut Bank Cr	intermittent	not sampled	----------
East Glacier[4] (31N12W18CDC)	none	Midvale Cr	intermittent	not sampled	----------
Priest Butte Lake (23N04W04___)	none	Teton River	regulated	Jan. 14, 1974	Flow ----------0.0 cfs
N. Mont. Feeders[5] (25N05W28___)	lagoon	Spring Coulee Drainage	never	Feb. 14, 1974	Flow ----------0.0 cfs
New Rockport Col.[6] (24N03W05___)	lagoon	Teton River	once only	April 23, 1974	Flow ----------0.0 cfs
Glendale Colony[6] (36N07W29DCD)	lagoon	dry trib. to Rocky Coulee	never	July 17, 1974	Flow ----------0.0 cfs
Glacier Colony[6] (36N05W35___)	holding tank	Hay Lake Drainage	never	July 17, 1974	Flow ----------0.0 cfs
Rockport Col.[6] (27N07W26CAC)	holding tank	S. Fk. Dry Fk. Marias River	never	July 9, 1974	Flow ----------0.0 cfs
Russell Johnson[6] (36N05W33BC-)	holding tank	dry trib. to Rocky Coulee	never	not sampled	----------

Waste Source and Location[1]	Treatment Type	Receiving Water	Discharge Type	Date Sampled	Discharge Characteristics (units are mg/l unless otherwise shown)
Fred Bergstrom[6] (27N01E29CC_)	holding tank	Rocky Coulee	never	not sampled	----------
Spike D Cattle Co.[5] (32N02W26C__)	retention pond	Medicine Rock Coulee	weather dependent	not sampled	----------
Sainfoin Feeders[5] (30N07W07D__)	retention pond	Hilger Coulee	weather dependent	not sampled	----------
Cut Bank WTP[7] clarifier (33N06W02DBD)	none	Cut Bank Cr	regulated	Jan. 15, 1974	Flow ---------- 200 gpm pH ---------- 7.4 S.U. Al ---------- 2.6
filter (33N06W02DAC)	none	Cut Bank Cr	regulated	Jan. 15, 1974	Flow ---------- 4,000 gpm pH ---------- 8.3 S.U. Al ---------- 4.0
Devon WTP[7] (30N02E19___)	none	Marias River	regulated	not sampled	----------
Big West Oil Ref. (35N03W35CDB)	lagoon	Shelby Coulee	never	Dec. 5, 1973	Flow ---------- 0.0 cfs
Triangle Packing (24N05W25CCC)	lagoon	Teton River	never	Jan. 14, 1974	Flow ---------- 0.0 cfs
Westco Oil Refinery (33N05W23BCC)	lagoon	Spring Coulee	continuous	Dec. 5, 1973	Flow ---------- 100 gpm TSS ---------- 0.0 COD ---------- 2,270 Cr ---------- 0.03 Cu ---------- 0.01 Zn ---------- 0.03 Fe ---------- 1.8 Oil and Grease ---------- 3.0 Total Phenol ---------- 2.0

(1) See Appendix C
(2) Bathwater & dishwater discharge
(3) Slaughterhouse Discharge
(4) Storm Drains
(5) Cattle Operation
(6) Hog Operation
(7) Water Treatment Plant

MINING

Mining apparently has no effect upon surface waters in the Marias basin. Mining has been very limited with only hard rock mining in the Sweet Grass Hills and low grade coal mining in central Pondera County the only activity of consequence.

Water Quality Bureau investigations revealed no seepage from the coal mines near New Miame (February 27, 1974) or from the mines in the Sweet Grass Hills (July 10, 1974). The coal mines near the mouth of Birch Creek reportedly have no seepage (Stoltz, 1974).

OIL

Oil exploration and development is a major activity in the Marias basin. In 1973 one of every six wells drilled in Montana was drilled in this basin. Most drilling is in the Cut Bank-Santa Rita-Kevin area; however, some exploration is in progress in all parts of the basin.

Normal drilling procedure involves the use of drilling mud. This mud is forced down the center of the drill to carry broken pieces of rock to the surface in a slurry. The slurry is contained in a pit; no reports of this slurry reaching a stream have been received although many wells have been observed very near Cut Bank Creek. Oil companies are now able to control "gushers" so that the oil is not lost and a water quality problem does not exist. Gushers can occur when drilling taps an oil reservoir and pressure is released causing crude oil to spray into the air for hundreds of feet.

Problems with oil polluting surface waters begins when a field begins to go dry. To pump more oil, water is forced down into the field. This causes the oil to be flushed thus allowing continued use of the field. Upon pumping such a field much water is obtained as well as the oil. This is generally separated in a basin and the water allowed to evaporate. Occasionally, dikes of the separation basin have been washed out and the oil-water mixture has flowed into a stream. This situation has been observed on Two Medicine Creek.

A potential source of water pollution from oil is from a pipeline break at or near the point the pipeline crosses a watercourse. Locations of these major stream crossings are provided in Table 6.

TABLE 6. OIL PIPELINE - STREAM CROSSINGS
IN THE MARIAS BASIN

Stream	Location*	Size Pipe	Responsibility
Cut Bank Creek	34N07W21AD_	8"	Continental Pipeline Co.
	34N07W21AD_	12"	Continental Pipeline Co.
	33N06W14D__	8"	Continental Pipeline Co.
	33N06W14D__	12"	Continental Pipeline Co.
	33N05W31___	gathering line	Phillips Petroleum Co.
Marias River	31N05W01___	5"	Phillips Petroleum Co.
	31N04W06BC_	8"	Continental Pipeline Co.
	31N04W06BC_	12"	Continental Pipeline Co.
Bullhead Creek	30N05W12___	5"	Phillips Petroleum Co.
	30N05W13___	5"	Phillips Petroleum Co.
Teton River	25N01W14___	5"	Phillips Petroleum Co.
	25N01E11CD_	8"	Continental Pipeline Co.
	25N01E11CD_	12"	Continental Pipeline Co.

*See Appendix C

RECREATION AND WILDLIFE FACILITIES AND FLOOD CONTROL

The only known water quality problem in the Marias basin related to recreation and wildlife and flood control is the discharge from Priest Butte Lake near Choteau, an area used for waterfowl hunting. The lake is a natural sump which collects water that apparently seeps from the Fairfield Bench. The water is high in dissolved solids and quality of the Teton River is lowered anytime a discharge from Priest Butte Lake occurs. Prior to 1954 discharge from Priest Butte Lake never occurred.

However, during that year the aqueduct from Priest Butte Lake to the Teton River was completed. This aqueduct made possible control of the lake's level, requested by local farmers and ranchers, the Montana Highway Commission and the Milwaukee Railroad after the flooding in 1953 and 1954.

Early discharges from Priest Butte Lake were not sampled and analyzed, but samples were obtained from the Teton River near Dutton. Total dissolved solids (TDS) at this point reached as high as 5,190 mg/l on September 7-8, 1954. Analysis of the Teton River near Dutton prior to opening the aqueduct revealed a TDS of 410 mg/l.

In July 1955 a canal connecting Priest Butte Lakes and Freezeout Lake was completed. This completed the flood control project as it allowed control of the levels of both lakes. Analysis of the Priest Butte Lake drain discharge after the completion of this canal revealed a TDS of as high as 16,600 mg/l on November 2, 1955. Since 1955, periodic flushing has improved the quality of Priest Butte Lake; TDS of 4,960 mg/l was recorded on July 25, 1969. However, due to the alkaline soil near the lake, the water quality should never approach the quality of the Teton River. Analysis of seeps and tributaries into the lake in 1974 revealed TDS concentrations of 7,226 mg/l, 11,979 mg/l and 4,602 mg/l.

INDIVIDUAL FACILITIES

Discharges from individual homes of sewage, grass clippings, and yard debris or solid waste affects the quality of surface water, in some cases, significantly. In 1974, individual sewage discharges have been discovered into the Marias River near Shelby and into Spring Creek near Choteau; grass clippings and yard debris have been observed in Spring Creek near Choteau and Pondera Creek near Conrad; solid waste has been observed in Pondera Creek near Conrad, North Fork Cut Bank Creek near Starr School, and Willow Creek near Browning. All discharges of this sort are unlawful and action by the Water Quality Bureau to correct these situations will be taken anytime a violator can be located.

VII. SURFACE WATER RESOURCES

The Marias basin contains four major sub-basins (Figure 1 and Plate 1). These are Cut Bank Creek, Two Medicine Creek, Teton River and the main stem of the Marias River with smaller tributaries. The Marias River and its major tributaries are shown schematically in Figure

The U. S. Geological Survey has maintained 52 streamflow gaging stations in the Marias drainage basin of which only 24 have a period of record of ten years or longer (Table 7) and 11 of these are presently active (Plate 1). Streamflow data has been recorded for the Marias River at four locations and for its main tributaries, Teton River, Dry Fork of the Marias River, Cut Bank Creek, Two Medicine Creek and Birch Creek. Typical streamflow data (Ref. 2, 1971) is presented in Tables 8 and 9 for the Marias River near Shelby and for the Teton River near Dutton. The total flow from the basin in water year 1971 exceeded 930,000 acre-feet. The largest tributary, Two Medicine Creek, provided 302,000 acre-feet or about 34 percent of the total flow.

Stream flows in the Marias basin are affected by local weather conditions, geology, reservoirs and irrigation (Table 8 and 9). A major part of the flow occurs during spring runoff; however, spring runoff is a function of weather and precipitation and may be quite variable in both time and volume. March through July is the most common snow melt period, but warm weather in mid-winter can cause significant short-term increases in stream flows. Peakflows from mountain streams such as Two Medicine Creek and the Teton River tend to occur from mid-May to late July; whereas foothill streams such as Shultz Coulee and Pondera Creek generally reach peak stream flows in March.

Erratic flows in the Teton River near Choteau and Birch Creek near Valier are due to storage reservoirs and upstream irrigation appropriation. Flow in the lower Marias is completely regulated by Tiber Dam. Flows in Shultz Coulee markedly increased during the irrigation period of mid-May to August 1974. Excess flows from the Pondera County Canal and Reservoir Company are diverted to Shultz Coulee, Pondera Creek and the Dry Fork Marias River (Stokes, 1974). Similar marked flow increases occur in Pondera Creek and Muddy Creek and decreases in the Teton River, Deep Creek, Dupuyer Creek and Birch Creek.

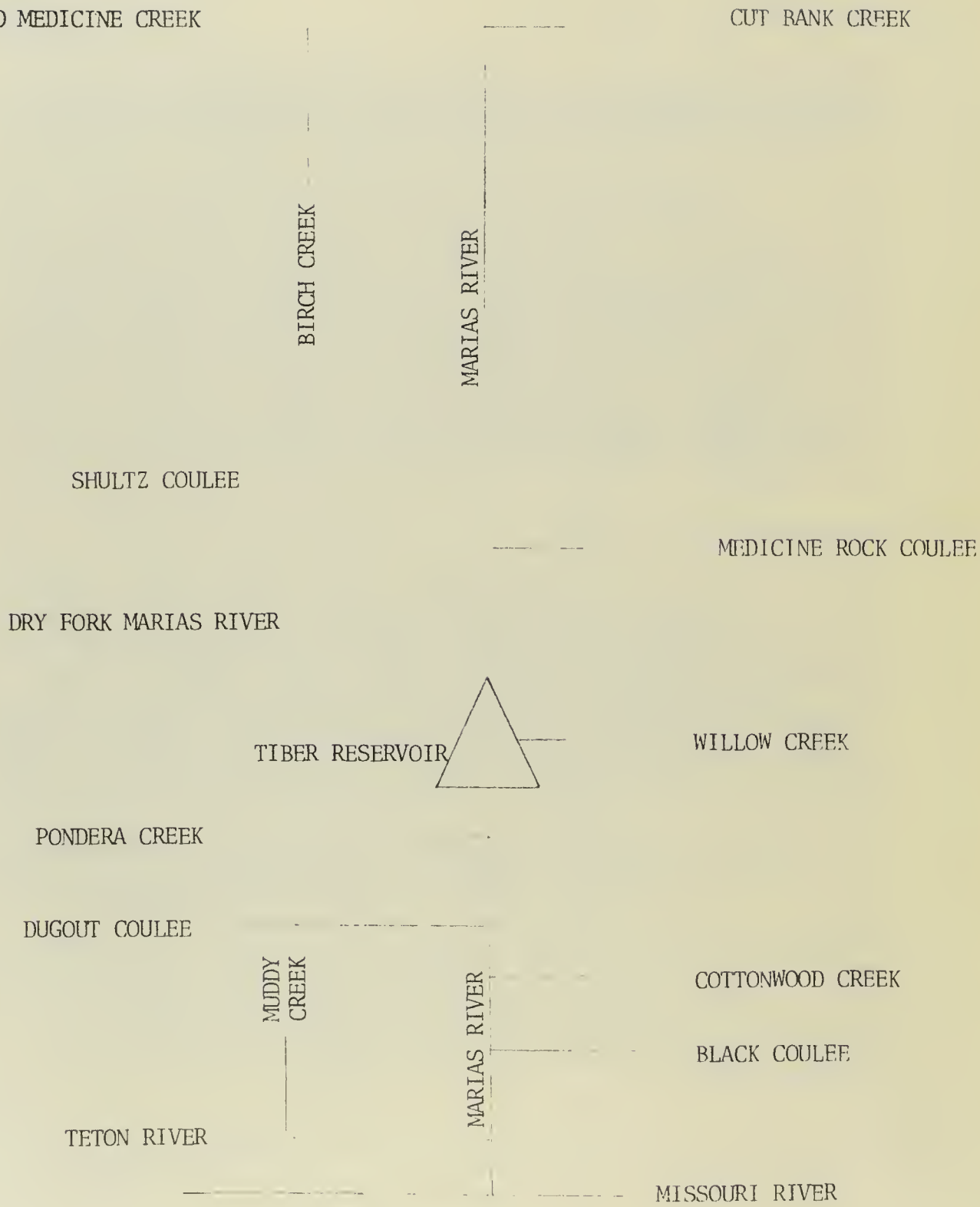


FIGURE 4. SCHEMATIC DIAGRAM OF STREAMS IN THE MARIAS BASIN

TABLE 7. SUMMARY OF STREAMFLOW FROM GAGED STATIONS IN THE MARIAS RIVER BASIN*

STATION NAME	LOCATION**	DRAINAGE AREA $(MI)^2$	YEARS OF RECORD***	MINIMUM STREAM FLOW (CFS)	7-DAY, 10-YEAR LOW FLOW (CFS)	AVERAGE ANNUAL FLOW (CFS)
Marias River nr Loma, Montana	25N09E04CD_	6,995	12 (disc)	180	70	957
Marias River nr Brinkman, MT	29N08E17DD_	6,425	35 (disc)	2.8	51	883
Marias River nr Chester, MT	30N05E34CC_	4,927	19	0.2	not available	903
Tiber Reservoir near Chester Montana	30N05E33B__	4,923	17	reservoir gage	reservoir gage	reservoir gage
Teton River nr Dutton, MT	25N01E12C__	1,307	18	12	not available	163
Dry Fork of Marias River at Fowler, MT	30N01W31A__	314	10 (disc)	0	mostly seasonal gaging	23.8
Marias River nr Shelby, MT	31N02W20DB_	3,242	66	10	64	952
Lake Francis nr Valier, Montana	29N05W23A__	reservoir gage	34	reservoir gage	reservoir gage	reservoir gage
Deep Creek nr Choteau, MT	23N05W15BC_	223	13 (disc)	3.0	6.40	70.4
Cut Bank Creek at Cut Bank, MT	33N06W11ADC	1,065	40 (disc)	4	8	195
Blackleaf Creek at Bynum, MT	26N06W22DB_	65	12 (disc)	0	mostly seasonal gaging	mostly seasonal gaging
Dupuyer Creek nr nr Valier, MT	29N06W33B__	111	25 (disc)	0	not available	49.2
Teton River at Strabane, MT	25N07W35AD_	170	16 (disc)	0	not available	151 before irrigation 68.8 after
Birch Creek at Robare, MT	30N07W31___	128	12 (disc)	0	not available	mostly seasonal gaging

TABLE 7 CONTINUED

STATION NAME	LOCATION**	DRAINAGE AREA $(MI)^2$	YEARS OF RECORD***	MINIMUM STREAM FLOW (CFS)	7-DAY, 10-YEAR LOW FLOW (CFS)	AVERAGE ANNUAL FLOW (CFS)
Birch Creek at Nelsons Ranch nr Dupuyer, MT	29N08W27B__	111	12 (disc)	0	not available	mostly seasonal gaging
Birch Creek nr Dupuyer, MT	29N08W28___	105	30 (disc)	3	4.5	159
Badger Creek nr Family, MT	31N08W19A__	239	17 (disc)	2.0	not available	265 before irrigation 217 after
Four Horns Lake nr Heart Butte, Montana	30N08W19___	reservoir gage	32	reservoir gage	reservoir gage	reservoir gage
Two Medicine Creek near Browning, MT	31N09W05DCB	317	38	1.1	4.2	382
Badger Creek nr Browning, MT	30N10W24A__	133	21	25	33	231
Two Medicine Canal near Browning, MT	31N10W23A__	canal gage	19	0	0	seasonal gaging
Birch Creek below Swift Dam nr Dupuyer, MT	28N10W23CC_	75.3	16 (disc)	0	not available	148
Swift Reservoir nr Dupuyer, MT	28N10W27A__	75.3	31	reservoir gage	reservoir gage	reservoir gage
Lower Two Medicine Lake near East Glacier, Montana	32N13W34A__	50.2	30	lake gage	lake gage	lake gage

*Not included in this list are twenty-eight stations of short duration (active for less than ten years).

**See attached "System for Geographical Location of Features" for explanation, Appendix I.

***"disc" indicates the station has been discontinued.

06099500 Marias River near Shelby, Mont.

LOCATION.--Lat 48°25'38", long 111°53'20", in E½NW¼SE¼ sec.20, T.31 N., R.2 W., Toole County, on left bank 200 ft downstream from bridge on U.S. Highway 91, 5.1 miles south of Shelby, 24 miles downstream from Cut Bank Creek, and at mile 168.

DRAINAGE AREA.--3,242 sq mi, of which 518 sq mi is probably noncontributing.

PERIOD OF RECORD.--April 1902 to December 1904, May 1905 to December 1906, May 1907 to January 1908, April 1911 to current year. Monthly discharge only for some periods, published in WSP 1309.

GAGE.--Water-stage recorder. Datum of gage is 3,087.72 ft above mean sea level. Prior to Dec. 23, 1947, nonrecording gage or water-stage recorder at several sites within 1,000 ft of present site at approximately the same datum.

AVERAGE DISCHARGE.--63 years (1902-4, 1905-6, 1911-71), 952 cfs (689,700 acre-ft per year).

EXTREMES.--Current year: Maximum discharge during year, 5,950 cfs May 28 (gage height, 6.77 ft); minimum daily, 140 cfs Jan. 13.

Period of record: Maximum discharge, 241,000 cfs June 9, 1964, largely due to failure of Swift Dam (gage height, 23.64 ft, from floodmark), from rating curve extended above 34,000 cfs on basis of slope-area measurement of peak flow; minimum observed, 10 cfs Aug. 20, 1919.

Flood in June 1908 may have exceeded 40,000 cfs.

REMARKS.--Records good except those for winter period, which are poor. Some regulation by Lower Two Medicine Lake, Four Horns Reservoir, Swift Reservoir and Lake Frances (see p. 182), having a combined capacity of 172,630 acre-ft. Diversions for irrigation of about 50,000 acres above station and about 15,000 acres below.

REVISIONS (WATER YEARS).--WSP 1309: 1903-4, 1918, 1921, 1933, 1935, 1947. WSP 1509: 1902, 1912(M), 1916, 1943(M). WSP 1729: Drainage area.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	367	415	185	175	205	360	958	1,900	5,720	1,790	638	276
2	379	407	180	170	205	360	932	2,030	5,250	1,600	590	282
3	371	391	175	170	205	370	900	2,520	4,760	1,570	545	272
4	351	391	180	170	205	380	829	3,130	4,440	1,580	492	254
5	343	387	200	170	200	400	793	3,660	4,360	1,550	469	234
6	347	433	210	170	200	420	775	3,890	4,530	1,440	451	215
7	363	424	220	170	205	420	861	4,460	4,660	1,350	428	191
8	359	407	215	170	215	433	978	4,210	4,640	1,310	399	179
9	363	420	210	165	240	451	1,000	4,410	4,630	1,170	379	161
10	383	424	200	160	300	464	1,000	4,680	4,440	1,140	375	182
11	391	403	205	155	400	464	1,140	4,560	4,060	1,100	359	227
12	530	420	210	145	600	482	1,010	4,590	3,780	1,120	350	227
13	575	424	205	140	1,400	525	926	4,940	3,640	1,120	330	221
14	545	407	210	145	3,000	492	842	5,300	3,600	1,020	310	224
15	456	411	210	150	2,600	525	854	4,710	3,580	958	300	227
16	428	415	205	160	2,160	469	1,070	4,010	3,180	920	270	227
17	407	403	190	170	1,510	438	1,120	3,790	2,740	894	230	265
18	379	403	180	200	1,160	424	1,090	3,580	2,520	900	206	307
19	375	391	170	250	1,060	411	984	3,210	2,450	906	206	314
20	363	347	170	380	926	380	932	3,110	2,380	900	206	355
21	367	230	175	500	751	350	1,020	3,000	2,390	861	212	391
22	383	170	175	250	671	320	1,250	2,750	2,510	805	218	379
23	387	165	175	230	704	318	1,540	2,620	2,620	787	234	351
24	391	165	180	220	676	359	1,740	2,690	2,680	787	262	328
25	339	190	190	220	644	442	2,340	3,020	2,600	781	254	318
26	307	185	190	215	555	451	2,900	3,730	2,440	775	230	314
27	321	180	190	215	433	469	2,350	4,440	2,390	721	212	318
28	367	175	190	215	379	515	1,940	5,210	2,250	688	191	314
29	407	190	195	215	------	575	1,730	5,830	2,080	751	185	314
30	420	190	200	210	------	638	1,810	5,420	2,050	793	182	328
31	424	------	180	210	------	861	------	5,430	------	698	227	------
TOTAL	12,188	9,963	5,970	6,285	21,809	13,966	37,614	120,830	103,370	32,785	9,940	8,195
MEAN	393	332	193	203	779	451	1,254	3,898	3,446	1,058	321	273
MAX	575	433	220	500	3,000	861	2,900	5,830	5,720	1,790	638	391
MIN	307	165	170	140	200	318	775	1,900	2,050	688	182	161
AC-FT	24,170	19,760	11,840	12,470	43,260	27,700	74,610	239,700	205,000	65,030	19,720	16,250

CAL YR 1970 TOTAL 378,223 MEAN 1,036 MAX 10,100 MIN 90 AC-FT 750,200
WTR YR 1971 TOTAL 382,915 MEAN 1,049 MAX 5,830 MIN 140 AC-FT 759,500

NOTE.--Stage-discharge relation affected by ice Nov. 21 to Feb. 15 (no gage height record Jan. 28 to Feb. 4).

06108000 Teton River near Dutton, Mont.

LOCATION.--Lat 47°55'45", long 111°33'12", near center of south line of SW¼ sec.12, T.25 N., R.1 E., Teton County, on right bank 1,500 ft upstream from Kerr Bridge, 0.9 mile downstream from Hunt Coulee, and 9.5 miles northeast of Dutton.

DRAINAGE AREA.--1,307 sq mi. Araa at site used prior to July 17, 1965, 1,308 sq mi.

PERIOD OF RECORD.--August 1954 to currant year.

GAGE.--Water-stage recorder. Altitude of gaga is 3,235 ft (from topographic map). Prior to July 17, 1965, water-staga recorder at site 1,800 ft downstream at datum 1.97 ft lower.

AVERAGE DISCHARGE.--17 years, 163 cfs (118,100 acre-ft par year).

EXTREMES.--Current year: Maximum discharge, about 1,700 cfs June 2 (gage height, 7.62 ft, backwater from road fill); maximum gage height, 8.90 ft Feb. 14 (backwater from ice jam); minimum daily discharge, 30 cfs Jan. 13.

Period of record: Maximum discharge, 71,300 cfs June 9, 1964 (gage height, 20.48 ft, present site and datum, from floodmark), from slope-area measurement of peak flow; minimum discharga, 12 cfs Nov. 17, 1963.

REMARKS.--Records fair except those for period of indefinite stage-discharge relation and those for winter period, which ara poor. Water is diverted on left bank in sec.34, T.25 N., R.7 W., for storage in Bynum Reservoir (usable capacity, 75,000 acre-ft). Diversions for irrigation of about 44,000 acres above station.

DISCHARGE, IN CUBIC FEET PER SECONO, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	81	59	75	45	80	185	297	277	1,260	212	90	70
2	80	57	75	45	85	200	257	267	1,620	196	81	87
3	83	57	70	40	80	200	237	254	1,440	170	75	70
4	80	61	70	40	80	200	223	257	1,170	160	95	66
5	79	73	75	45	80	200	219	277	991	146	95	68
6	81	74	80	45	85	200	214	383	888	133	88	69
7	84	68	85	45	100	200	219	574	838	123	92	66
8	83	68	87	45	130	200	225	665	847	123	87	61
9	83	69	87	40	150	195	219	542	865	131	78	59
10	83	67	85	35	175	195	209	472	937	127	75	58
11	78	67	85	35	200	195	198	453	699	117	76	57
12	76	68	80	35	300	180	185	428	472	110	74	59
13	75	68	70	30	400	180	177	425	404	104	67	59
14	73	72	60	35	700	180	164	595	377	96	63	54
15	72	72	50	35	600	180	152	825	363	89	55	57
16	69	75	45	40	500	180	148	888	354	87	53	56
17	67	73	40	45	508	175	154	711	354	78	50	57
18	63	73	35	50	377	180	168	657	319	70	47	65
19	61	75	35	55	316	180	166	747	292	68	44	67
20	61	69	35	60	274	170	181	865	272	66	42	75
21	58	50	40	150	252	160	200	661	272	66	39	79
22	58	45	40	110	230	145	266	529	269	65	38	79
23	63	50	45	95	216	133	308	431	295	66	35	79
24	66	65	45	90	209	209	284	360	316	63	34	79
25	64	70	45	85	297	214	267	324	300	63	38	79
26	60	70	40	85	189	200	284	319	289	63	45	81
27	60	65	40	85	183	207	338	340	257	66	45	76
28	59	60	40	85	190	212	357	401	225	75	43	72
29	55	75	45	80	------	252	313	624	209	84	42	68
30	54	80	50	75	------	262	292	684	219	105	45	66
31	58	------	50	75	------	282	------	747	------	104	57	------
TOTAL	2,167	1,995	1,804	1,860	6,986	6,051	6,921	15,982	17,413	3,226	1,888	2,038
MEAN	69.9	66.5	58.2	60.0	250	195	231	516	580	104	60.9	67.9
MAX	84	80	87	150	700	282	357	888	1,620	212	95	87
MIN	54	45	35	30	80	133	148	254	209	63	34	54
AC-FT	4,300	3,960	3,580	3,690	13,860	12,000	13,730	31,700	34,540	6,400	3,740	4,040

CAL YR 1970 TOTAL 57,257 MEAN 157 MAX 1,000 MIN 32 AC-FT 113,600
WTR YR 1971 TOTAL 68,331 MEAN 187 MAX 1,620 MIN 30 AC-FT 135,500

NOTE.--Staga-discharge relation affacted by ice Nov. 22 to Feb. 16. Staga-discharge relation indefinite Apr. 22 to Sept. 30.

VIII. WATER QUALITY

Water quality has been regularly measured at 27 stations in the Marias basin with some stations overlapping from agency to agency. Prior to the Water Quality Bureau stations established in 1973, stations were established by the U.S.G.S. for special studies at Mission Lake and at Priest Butte Lake. Water quality in the main stem of the Marias and in the basin's western portion is good to excellent while the water of tributaries and springs on the plains ranges from fair to poor.

The basin has many water quality problems. Fecal coliforms are very high in Midvale Creek due to discharges of poorly treated sewage from East Glacier Park and East Glacier Lodge. Priest Butte Lake and all tributaries to Priest Butte Lake are significantly affected by alkaline seeps. Alkali Lake has very high salinity due to inflows of highly alkaline water plus being an evaporation basin for a small drainage. Two Medicine Creek and Birch Creek are temporarily affected by highly turbid discharges from the Badger-Fisher main canal. Shultz Coulee is severely eroded due to poor irrigation practices from the Pondera County Canal and Reservoir Company. Hilger Coulee is severely degraded by highly alkaline water seeping into its drainage. The Teton River undergoes a significant change between Choteau and Collins, thought to be in part a result of the effect of irrigation return flows to the river.

Cottonwood Creek

Four attempts to sample Cottonwood Creek south of Chester were made in 1974 with no success due to the fact that the stream is normally dry at this point. Chester is the only city in the drainage and the sewage lagoon for Chester is apparently the potential source of water pollution in this drainage. The major land used in the drainage is dryland wheat farming which normally has little effect on water quality.

Cut Bank Creek

Cut Bank Creek is formed in a small headwaters area of Glacier National Park and includes Browning, Starr School and Cut Bank in its drainage. Periodic samples have been taken from Cut Bank Creek at Cut Bank and from Willow Creek, a major tributary, at Blackfoot. Grab samples have been obtained from Old Maid Coulee at Cut Bank, Rocky Coulee near Santa Rita and Depot Creek at Browning. Small irrigation plots are under development on the mainstream of Cut Bank Creek as well as on Willow Creek. A major irrigation project on the Seville Bench west of Cut Bank uses water from Two Medicine Creek and wastes water to Cut Bank Creek.

Oil exploration and pumping occurs in the east part of the drainage, including Seville Bench, Rocky Coulee and Old Maid Coulee areas. Samples from Cut Bank Creek at Cut Bank revealed a phenol concentration of 0.009 mg/l on July 3, 1951, an indication that petroleum products were seeping or spilling into the creek. Samples taken in 1974 contained no phenolic compounds. Typical data of the Cut Bank Creek drainage is shown in Table 10.

TABLE 10. TYPICAL QUALITY OF VARIOUS STREAMS IN THE CUT BANK CREEK DRAINAGE
(all values are mg/l unless otherwise stated)

Station	Location(1)*	Ca	Mg	Na	HCO_3	Cl	SO_4	NO_3	F
(1) Cut Bank Cr nr Cut Bank (4-11-74)	33N06W11ADB	41	21	58	204	4.5	131	0.0	0.16
(2) Old Maids Coulee at the mouth (October 25. 1973)	33N06W02DAC	86	66	420	585	53	788	1.8	0.60
(3) Willow Creek at Blackfeet (4-11-74)	33N10W36C--	45	24	21	188	2.0	102	0.22	0.15
(4) Depot Creek at Browning (2-15-74)	32N11W11BDC	96	43	63	268	4.2	3.9	0.95	--

Station	PO_4	Fe	pH (standard units)	T(°C)	Specific Conductivity µmhos/cm @ 25°C
(1)	0.08	0.58	8.3	6.0	611
(2)	1.0	1.0	8.3	4.0	2,422
(3)	0.43	0.75	8.0	5.0	502
(4)	0.00	--	8.0	0.5	1,070

(1)*See Appendix C

A detailed assessment of the effect of irrigation and oil activities on the creek has not been made. A planned investigation by the Water Quality Bureau regarding saline seep will examine this area in detail. The reason for the proposed investigation is the increase in TDS in Cut Bank Creek between 1951 and 1974 (Table 11).

TABLE 11 COMPARISON OF TYPICAL CUT BANK CREEK WATER QUALITY DATA 1951 AND 1974

Date	Flow (cfs)	TDS (mg/1)	specific conductivity μmhos/cm @ 25°C	pH Standard Units
(1) August 1, 1951	217	178	309	7.5
(2) April 11, 1974	245	460	611	8.3

	SO_4 (mg/1)	Cl (mg/1)	Mg (mg/1)	Ca (mg/1)	NO_3 (mg/1)	PO_4 (mg/1)	Fe (mg/1)
(1)	1.0	34	13	32	0.5	--	0.2
(2)	4.5	131	21	41	0.0	0.08	0.58

The two sampling stations are 1.75 miles apart, but both are located below the Cut Bank sewage discharge and water plant discharges; therefore the quality of the creek should be similar at both stations.

Dry Fork Marias River

The Dry Fork of the Marias River has its headwaters in the hills near the Rockport Colony west of Pendroy. The river flows generally northeast through irrigated farmland, pastureland, and occasional oil drilling operations. Rockport Colony is the only large community in the drainage. The Dry Fork of the Marias River is one of the poorest quality perennial streams in the Marias basin. At the sampling station above Flat Coulee at Ledger the total dissolved solids concentration averages 1,560 mg/1 and total hardness averages 694 mg/1 for the three samples taken during the study. High values of common ions have been recorded at this station including the highest concentrations in the Marias basin for calcium, magnesium, sulphate, and nitrate. These concentrations are fairly high at Manson, but increase significantly between Manson and Ledger (Table 12).

TABLE 12. TYPICAL WATER QUALITY OF THE DRY FORK MARIAS RIVER DRAINAGE

	TOTAL DISSOLVED SOLIDS (mg/1)	TOTAL HARDNESS (mg/1)	TOTAL AMMONIA (mg/1)	CALCIUM (mg/1)	MAGNESIUM (mg/1)	SODIUM (mg/1)	BICARBONATE (mg/1)	SULPHATE (mg/1)	CHLORIDE (mg/1)	NITRATE (mg/1) as NO_3	TEMPERATURE (°C)	pH (Standard Units)
Dry Fk at Manson (March 7, 1974)	1,162	433	0.02	84	54	17	357	480	16.1	0.23	0	8.2
Spring Creek at Manson (March 7, 1974)	1,148	458	0.01	79	64	158	311	526	10.5	0.55	0	8.1
Dry Fork Above Little Dry Coulee March 7, 1974)	--	--	0.01	--	--	--	--	--	--	--	0	--
Little Dry Coulee at Dry Fork:												
(August 13, 1974)	--	350	--	66	45	55	129	220	93	--	15	7.8
(March 7, 1974)	--	--	8.50	--	--	--	--	--	--	--	--	--
(Dec. 5, 1973)	--	--	9.9	--	--	--	--	--	--	--	1.0	8.1
Dry Fork at Ledger (March 7, 1974)	1,606	717	0.05	119	102	202	360	797	22.0	4.10	--	8.1

Some of these increases shown in the table may be due to a change in geology as the stream enters the Cretaceous Shales near Manson or may be a result of poor quality water seeping into the drainage, or a combination of the two. Any seepage should increase during irrigation, possibly having more effect upon this stream.

Little Dry Coulee discharges to the Dry Fork of the Marias River between Manson and Ledger and contains the Conrad sewage discharge. This coulee has a concentration of total ammonia that is toxic to fish. This water is diluted when discharged to the Dry Fork but probably is still toxic to fish for a short distance downstream. Discharges to the Dry Fork Marias River at the Rockport Colony were not sampled and analyzed since these discharges are soon to be eliminated.

Marias River

The Marias River is formed twelve miles north of Valier at the confluence of Two Medicine Creek and Cut Bank Creek. The river flows approximately 50 miles before discharging into Tiber Reservoir and flows for 68 miles after leaving Tiber Reservoir before discharging into the Missouri River. Major tributaries of the Marias River are Shultz Coulee, Medicine Rock Coulee and the Dry Fork of the Marias River above Tiber Reservoir, Willow Creek into the reservoir and Pondera Creek, Dugout Coulee, Cottonwood Creek, Black Coulee and the Teton River below Tiber Dam. Water quality of the Marias River has been determined from samples taken at the Highway 91 bridge near Shelby, at Tiber Dam and at Loma (Table 13). Two Medicine Creek is included since it is the largest tributary to the Marias River.

TABLE 13-TYPICAL WATER QUALITY OF THE MARIAS RIVER AND TWO MEDICINE CREEK

Station	TDS (mg/1)	pH (standard units)	T	specific conductivity μ mhos/cm @ 25°C
(1)Two Medicine Cr at Highway 358 (April 11, 1974	261	8.2	6.0°C	353
Marias near Shelby (2)October 4, 1950	288	7.7	45°F	462
(3)June 14, 1950	198	6.9	58°F	321
Marias at Tiber Dam (4)October 18, 1973	408	8.0	11.0°C	519
Marias at Loma (5)April 17, 1974	467	8.5	9.0°C	579

Station	Suspended Sediment and/or Turbidity	Ca (mg/1)	Mg (mg/1)	Na (mg/1)	HCO_3 (mg/1)	SO_4 (mg/1)
(1)	42 mg/1	42	13	6	132	68
(2)	24 mg/1	55	17	-	194	88
(3)	2,530 mg/1	38	11	-	144	46
(4)	1 JTU	53	21	27	165	138
(5)	2 mg/1	57	23	31	174	165

Station	Cl (mg/1)	NO_3 (mg/1)	PO_4 (mg/1)	Fe (mg/1)
(1)	0.2	0.00	0.08	1.30
(2)	2.0	0.70	--	0.04
(3)	1.0	0.60	--	0.04
(4)	2.5	0.22	0.07	0.12
(5)	3.0	0.26	<0.03	1.20

The data shows that the concentrations of constituents increases downstream with much of the change occurring between Cut Bank and Shelby. This change is probably a result of inflows from poor quality streams and from the geological change as the river enters the Colorado Shale.

Streams entering the Marias River above Tiber Reservoir are of very low quality (Table14).

TABLE14-ANALYSIS OF UPPER MARIAS RIVER TRIBUTARIES

	Specific Conductance μ mhos/cm at 25°C	Total Dissolved Solids (mg/l)	Flow (cfs)
Sixdeer Coulee April 19, 1974	3,700	--	0.1 (est.)
Shultz Coulee April 19, 1974	2,600	--	2 (est.)
Hilger Coulee April 19, 1974	22,100	--	0.3 (est.)
Marias at Shelby October 4, 1950 (USGS)	462	288	538
Dry Fork Marias River April 11, 1974	1,930	1,467	3 (est.)

Shultz Coulee is a lowland drainage which discharges to the Marias River from the south approximately 20 miles northwest of Conrad. Included in its drainage are Valier and a large portion of the Pondera County Canal and Reservoir Company's Irrigation District. The coulee is used by this irrigation district as a drainage to return used water to the Marias River (Stokes, 1974). This was also shown by measured flows of the coulee by the Water Quality Bureau. On April 19, 1974 the flow at the mouth was estimated at 2 cfs, but on June 4, 1974, flows were 46.3 and 46.0 respectively. Flow regulation has a very noticeable effect upon the sediment concentration in Shultz Coulee. On June 4, 1974 the banks of the river were being rapidly eroded by the stream due to flood flow. Suspended sediment concentrations for samples were 150 JTU on June 4, 1974 and 60 JTU on August 7, 1974 while the turbidity on April 19, 1974, before irrigation began, was 1.0 JTU.

Hilger Coulee is a lowland drainage which discharges to the Marias River from the south, seven miles south of Shelby. This is extremely

poor quality water probably resulting from highly alkaline water seeping into the drainage. Further examination of this coulee is planned by the Water Quality Bureau in conjunction with their saline seep study.

Suspended sediment is of major concern on the Upper Marias. Data collected by the USGS at the station near Shelby from 1947 to 1952 reveals suspended sediment reached a minimum of 1 mg/l on June 25, 1950 when the flow was 180 cfs and a maximum of 4,940 mg/l on June 25, 1951 when the flow was 11,500 cfs. Between these extremes the flow generally stabilizes from 400 cfs to 2,000 cfs, and suspended sediment from 30 to 500 ppm. This high sediment load is probably due in part to an unstable stream bed, but return irrigation flows from the Badger-Fisher Main Canal (see Two Medicine Creek) and the Pondera County Canal and Reservoir Company add significantly to the problem.

Medicine Rock Coulee

Medicine Rock Coulee is a normally dry watercourse that drains a glaciated plain located north and west of Shelby and containing 580 square miles. The area is the dry lake beds of Virden Lake and ALoe Lake which are fed by springs on the west and intermittent coulees on the east. For much of the year, the coulees feeding these lakes become dry before reaching either of the lake beds. During the snow melt it is probable that flow reaches Aloe and Virden Lakes and possible that the lakes discharge past Shelby into the Marias River. Water has been observed flowing past the Shelby sewage lagoons (Voorhees, 1974). On April 20, 1974, the coulee was observed to be dry at the mouth on the Marias River. Major land uses in the drainage are oil drilling and refining and dryland farming. Other uses are livestock grazing and irrigated farming.

Included in the basin are Shelby, Kevin, Oilmont, Big West Oil Refinery and the Westco Refinery. No waste discharges occur from the community of Kevin and Oilmont or from the Big West Oil Refinery located at Kevin. Sewage is discharged from the Shelby sewage lagoons and probably reaches the Marias River, six miles distance, during wet periods of the year.

Significant pollution occurs as a result of the discharge from the Westco Oil Refinery into Spring Coulee. Spring Coulee flows east from the Westco Refinery past Ethridge into Aloe Lake. Normally, the coulee is dry 2.5 miles north from Ethridge. On January 16, 1974 a sample collected three miles northwest of Ethridge revealed a phenol concentration of 0.88 mg/l and a TDS of 3,579 mg/l. A benthic survey revealed that only beetles, very hardy insects, live in Spring Coulee while sensitive caddisflies were found in Boru Spring, one of the coulee's tributaries.

Pondera Creek

Similar to the Dry Fork Marias River, Pondera Creek is a low quality stream, having a total dissolved solids concentration of 1,066 mg/l

and a total hardness of 554 mg/l. The creek has its headwaters on Porter Bench near Gallup City and includes the cities of Conrad and Brady. Major land uses are dryland farming and livestock production. Discharges to the basin include the Brady sewage lagoon and two storm drains at Conrad. The nature of these discharges and their impact on Pondera Creek were not determined.

Potential sources of pollution to Pondera Creek are the oil drilling operations at Gallup City and north of Brady; irrigation returns from the Pondera County Canal and Reservoir Company and from the Brady Irrigation Company and discharges due to increased water use as the Tiber Water Users project expands. As of this writing, data from samples collected from Pondera Creek near the mouth does not indicate any problem from either of these potential sources. Flow has varied at the sampling point but the quality of the water has remained relatively constant.

Teton River

The Teton River drainage involves more area than any of the Marias River tributaries, occupying approximately one-fifth of the Marias basin. Included in the drainage are the communities of Choteau, Dutton and Miller Colony. Land use varies from forests in the western section, irrigated farming in the central portion and dryland farming in the eastern section. The only discharges that reach surface waters are from the Choteau sewage lagoon and the Priest Butte Lake aqueduct.

Above Choteau, the Teton River and Deep Creek are adversely affected by irrigation withdrawal of most of the streams' flow. Deep Creek is periodically dry at Highway 287 due to irrigation diversions, and the Teton River is periodically dry below the Bynum and Eureka diversions (Hill, 1974). Some of this diverted water is returned to the Teton River between Choteau and Collins. The Teton River has been channelized above Choteau in an effort to alleviate flood problems. The combination of water withdrawals and stream channelization has apparently significantly decreased the amount of aquatic life in the river near Choteau (Hill, 1974).

Water quality in the Teton River is good to excellent in the headwaters but is degraded significantly by the time it reaches Collins. Between Collins and Loma, no appreciable change in water quality occurs except for increases in heavy metal concentrations (Table 15).

TABLE 15--TYPICAL WATER QUALITY DATA OF THE TETON RIVER

Station	Location(1)*	pH (Standard Units)	Total Nonfilterable Residue (mg/1)	T (°C)
(1)Teton at Teton-view School (April 24, 1974)	25N07W35ADD	8.3	< 2	4.0
(2)Teton at Highway 89 at Choteau (September 6, 1956 (USGS)	--	7.9	--	--
(3)Teton at Collins (December 3, 1973)	25N02W14DBA	7.7	--	--
(4)Teton near Dutton (April 24, 1974)	25N01E12CCC	8.3	44	12.5
(5)Teton at Loma (April 17, 1974)	25N09E12DBD	8.4	36	11.0

Station	specific conductivity μ mhos/cm @ 25°C	TDS (mg/1)	total hardness as $CaCO_3$ (mg/1)	Ca (mg/1)	Mg (mg/1)
(1)	393	314	208	58	15
(2)	530	316	234	57	22
(3)	659	659	367	69	47
(4)	743	623	322	62	41
(5)	795	654	324	53	47

Station	Na (mg/1)	HCO_3 (mg/1)	SO_4 (mg/1)	Cl (mg/1)	NO_3 (mg/1)	PO_4 (mg/1)
(1)	1	188	52	0.7	0.14	0.03
(2)	24	260	70	1.5	0.20	--
(3)	40	303	197	2.8	0.10	< 0.01
(4)	48	259	237	4.7	0.86	0.47
(5)	59	246	237	4.0	0.00	0.05

(1)*See Appendix C

Closer examination of the data shows that the greatest change in water quality occurs between the Highway 89 bridge in Choteau and Collins. In this stretch, Spring Creek, Caskey Coulee, Gamble Coulee, Spring Coulee, and the Priest Butte Lakes discharge to the Teton River. During the study period, the Priest Butte Lake aqueduct was never opened and analysis of Spring Creek shows that is a very high quality stream. Therefore, this change is probably due to a combination of the discharges of Spring Creek, Gamble Coulee and Caskey Coulee, streams that carry irrigation wastewaters and geological changes as the river enters the Colorado Shale.

Two Medicine Creek

Two Medicine Creek is the largest tributary to the Marias River contributing approximately one third of the river's flow. The headwaters extend for approximately 45 miles along the Continental Divide and give rise to the tributaries of Dupuyer Creek, Birch Creek, Blacktail Creek, Whitetail Creek, and Badger Creek, as well as Two Medicine Creek. Major communities in the basin are East Glacier Park, Dupuyer and Birch Creek Colony. The Two Medicine Creek drainage is essentially two drainages since Birch Creek discharges to Two Medicine Creek near the mouth.

In the headwaters, the water is of excellent quality (Table 16).

TABLE 16 WATER QUALITY IN THE TWO MEDICINE CREEK HEADWATERS

	Location	TDS (mg/l)	Total Hardness as $CaCO_3$ (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)
(1) Deep Creek July 21, 1973	30N12W23	145	93	26	6.8	--
(2) Spring near Deep Creek July 21, 1973	20N12W23	193	109	30	8.4	6.4
(3) Midvale Creek at East Glacier water intake August 1965	------	54	45	14	3.0	--

	NO_3 (mg/l)	HCO_3 (mg/l)	SO_4 (mg/l)	Cl (mg/l)	Fe (mg/l)
(1)	0.28	112	--	0.0	0.44
(2)	0.41	145	2.9	0.0	0.04
(3)	0.0	75	9	5	0.94

Near East Glacier Park, Two Medicine Creek combines with Midvale Creek which is polluted by three sewage discharges and seepage from the East Glacier solid waste landfill. The sewage discharges are by seepage from the East Glacier Lodge lagoon, from the community septic tank and from an undetermined source discharging between the railroad tracks and the East Glacier Lodge lagoon. No quality data were obtained for Midvale Creek near the mouth, but due to the four discharges it is fairly safe to assume that water in Midvale Creek exceeds Montana's Water Quality Standards at least until it discharges into Two Medicine Creek, a distance of approximately four miles. Data obtained from those sewage discharges are shown in Table 17.

TABLE 17. WATER QUALITY OF EAST GLACIER SEWAGE DISCHARGES

	Flow (cfs)	BOD_5 (mg/l)	Total Coliform per 100 ml	Fecal Coliform per 100 ml	TOC
East Glacier lagoon seepage (Sept. 5, 1973)	--	6	49	49	--
Discharge between railroad and East Glacier Lodge lagoon (Sept. 5, 1973)	0.1	--	2,400	2,400	--
(July 18, 1974)	0.1	--	--	800	--
East Glacier septic tank discharge (May 16, 1974)	0.05	48	--	444,000	25

The only samples taken of Midvale Creek were taken just upstream from the East Glacier septic tank discharge. These samples showed a total coliform count of 220 and a fecal coliform count of 170 per 100 milliliters.

Samples taken in the coulee directly above and below the East Glacier landfill indicate significant degradation of the water quality due to seepage from the landfill. Chemical oxygen demand (COD) increases from 1.2 to 35 mg/l, nitrate (NO_3) increases from 0.0 to 1.5 mg/l, zinc increases from 0.01 to 0.11 mg/l and specific conductance increases from 136 to 569 micromhos/cm at 25°C. Flow in this coulee is intermittent so the effect of the landfill on Midvale Creek is not continuous.

The next point at which data are available for Two Medicine Creek is at the Highway 89 bridge southeast from Browning. At this point the creek still is of excellent quality having an average dissolved solids concentration of 97 mg/l and a hardness of 75 mg/l as $CaCO_3$. Between

East Glacier Park and Highway 89, Two Medicine Creek is joined by Elk Creek and the South Fork of Two Medicine Creek. The slight increase in dissolved solids observed at Highway 89 may be a result of Elk Creek which has its headwaters in the pothole region between East Glacier and Browning. Analysis of streams of similar origin in the basin consistently show more dissolved minerals than from streams with mountain headwaters.

Between Highway 89 and Highway 358, approximately 30 river miles, the quality of Two Medicine Creek changes significantly as shown in the following table.

TABLE 18 TYPICAL WATER QUALITY OF TWO MEDICINE CREEK

Station	Flow (cfs)	Specific Conductivity µmhos/cm @ 25°C	pH (Standard Units)	TDS (mg/1)	Total Hardness as $CaCO_3$ (mg/1)
(1) Two Medicine Cr at Highway 89 (USGS) (Feb. 25, 1956 to March 18, 1956)	63.0	231	7.8	138	106
(2) Two Medicine Cr at Highway 358 (October 25, 1973)	45	558	8.1	432	265

Station	Ca (mg/1)	Mg (mg/1)	Na (mg/1)	HCO_3 (mg/1)	Cl (mg/1)	SO_4 (mg/1)	NO_3 (mg/1)	Fe (mg/1)
(1)	28	8.8	5.2	112	0.0	29	0.1	0.00
(2)	69	23	13	195	0.8	132	0.0	0.07

These increases are probably due to plains tributaries or seeps into Two Medicine Creek or into Badger Creek (the main tributary between the two sampling stations). Fecal coliform has ranged from 7 to 47 per 100 milliliters during normal flow at Highway 358, an indication that the East Glacier sewage does not cause a significant effect at this point.

Tests for oil and grease and phenols have been performed at Highway 358 and the results show that Two Medicine Creek is not continuously affected by discharges of this material. Problems with oil spills from the Miami Oil Producers field (Boland, 1974) led to the establishment of the sampling point at Highway 358, but no oil and grease and phenols were detected during this investigation.

Turbidity is a major problem on lower Two Medicine Creek due to irrigation return flows from the Badger-Fisher main canal (aerial observation - July 9, 1974). Water in the canal flows from Badger Creek and Four Horns Lake and discharges to Two Medicine Creek above Highway 358. Samples taken from Two Medicine Creek above the discharge and at Highway 358 show a turbidity increase from less than 1 to 30 JTU. This sediment is carried downstream for 70 miles before it settles out in Tiber Reservoir.

Seven miles below the Highway 358 bridge Two Medicine Creek is degraded by discharge from Birch Creek. Data from Birch Creek and Two Medicine Creek above Birch Creek are compared in Table 19.

TABLE 19. COMPARISON OF WATER QUALITY IN BIRCH CREEK AND TWO MEDICINE CREEK

Station	Location(1)*	Flow (cfs)	T (°C)	Specific Conductivity μmhos/cm @ 25°C	pH (Standard Units)
(1) Birch Creek (October 25, 1973)	30N06W14D__	22	5.0	676	8.3
(2) Two Medicine Cr (Oct. 25, 1973)	31N06W02CCB	45	6.0	558	8.1

Station	TDS (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	HCO_3 (mg/l)	Cl (mg/l)	SO_4 (mg/l)	NO_3 (mg/l)	PO_4 (mg/l)
(1)	555	49	30	59	289	2.5	125	0.13	0.0
(2)	432	69	23	13	195	0.8	132	0.0	0.0

(1)*See Appendix C

The higher concentrations observed in Birch Creek are thought to be a result of the lowland drainages of Blacktail Creek, Cartwright Coulee, Laughlin Coulee, and Sheep Creek which would affect the higher quality water of Dupuyer Creek and Birch Creek. This opinion is based upon two grab samples of creeks in the middle part of the Birch Creek drainage which are compared in the following table.

TABLE 20 COMPARISON OF WATER QUALITY IN BIRCH CREEK AND ITS TRIBUTARY BLACKTAIL CREEK

Station	TDS (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	HCO_3 (mg/l)	SO_4 (mg/l)
(1) (mountain watershed) Birch Creek at Highway 89 Feb. 14, 1974	309	48	15	11	198	37
(2) (plains watershed) Blacktail Creek at Highway 89 Feb. 14, 1974	706	65	34	78	327	200

Station	Cl (mg/l)	NO_3 (mg/l)	Flow (cfs)	Specific Conductivity µmhos/cm @ 25°C
(1)	0.3	0.40	20 (est)	420
(2)	2.0	0.42	7 (est)	880

Aerial observation on July 9, 1974 revealed excessive turbidity in Birch Creek as a result of the Badger-Fisher main canal. The canal was observed discharging into Birch Creek in 30N06W23, approximately one mile above the Highway 358 bridge.

Willow Creek

Four attempts to sample Willow Creek near Galata were made in 1974 with no success due to the fact that the stream is normally dry. No large towns are included in the basin and the only potential source of water quality problems are oil drilling operations near Ferdig (Section VI).

TABLE 21

WATER QUALITY SAMPLING STATIONS

LOCATION DESCRIPTIONS

Location	Longitude	Latitude	Legal	Parameters	Period of Record
ıt Bank Creek at Cut Bank	48°37'59"	112°20'47"	33N06W11ADB	pH, temp, cond, TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, PO_4, turbidity, As, Cu, Cd, Fe, Pb, Zn, F, total coliform, fecal coliform, total non-filterable residue, benthic assessment	bi-monthly Sept. 1973 - Aug. 1974
Willow Creek ıt Blackfoot	48°34'__"	112°51'__"	33N10W36C__	pH, temp, cond, TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, F, PO_4, total coliform, fecal coliform, fecal strep, total nonfilterable residue, Zn, Fe, Cd, Mn, As, Cu	bi-monthly April 1974 - Aug. 1974
Birch Creek near Valier	48°22'__"	112°20'__"	30N06W14D	pH, temp, cond. TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, F, PO_4, turbidity, As, Cu, Cd, Fe, Pb, Zn, total coliform, fecal coliform, total nonfilterable residue, DO	bi-monthly Sept. 1973 - Aug. 1974
Medicine Creek near Cut Bank	48°28'18"	112°21'29"	31N06W02CCB	pH, temp. cond. TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, F, PO_4, turbidity, As, Cu, Cd, Fe, Pb, Zn, total non-filterable residue, total coliform, fecal coliform	bi-monthly Nov. 1973 - Aug. 1974
Muddy Creek at Collins	47°56'__"	111°48'__"	25N02W11ADD	pH, temp, cond, TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, F, PO_4, fecal coliform, ortho phosphate, turbidity	bi-monthly Dec. 1973 - Aug. 1974
Teton River near Choteau	47°53'__"	112°28'__"	25N07W35ADD	pH, temp, cond. TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, PO_4, fecal coliform, Cu, Mn, Fe, Zn, As, Cd, total non-filterable residue	semi-annually April 1974 - Oct. 1974
Teton River ıt Collins	47°55'__"	111°49'__"	25N02W14DBA	pH, temp, cond. TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, fecal coliform, BOD, ortho phosphate	semi-annually Dec. 1973 - June 1974

LOCATION DESCRIPTIONS

Agency	Station Number	Location	Longitude	Latitude	Legal	Parameters	Period of Record
Montana Dept. of Health & Environmental Sciences	--	Teton River near Dutton	47°56'__"	111°33'__"	25N01E12CCC	pH, temp, cond, TDS, SAR, hardness, alkalinity, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, fecal coliform, BOD, ortho phosphate, Zn, Cd, Fe, DO, turbidity, Cu, Pb, As	bi-monthly Sept. 1973 - Aug. 1974
Montana Dept. of Health & Environmental Sciences	--	Teton River at Loma	47°57'__"	110°30'__"	25N09E12DBD	pH, temp, cond, SAR, hardness, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, PO_4, total coliform, BOD, Mn, Cd, As, fecal coliform, Fe, Cu, Zn	bi-monthly Feb. 1974 - Aug. 1974
Montana Dept. of Health & Environmental Sciences	--	Willow Creek at Galata	48°27'__"	111°20'__"	31N03E16AAC	Not yet sampled - no flow.	bi-monthly Feb. 1974 - Aug. 1974
Montana Dept. of Health & Environmental Sciences	--	Cottonwood Creek near Chester	48°19'__"	110°51'__"	30N07E29CAD	Not yet sampled - no flow.	bi-monthly Feb. 1974 - Aug. 1974
Montana Dept. of Health & Environmental Sciences	--	Dry Fork Marias at Ledger	48°15'__"	111°49'__"	29N02W23AD	pH, temp, cond, TDS, SAR, hardness, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, PO_4, total coliform, Fe, Cu, Pb, As, fecal coliform, turbidity, Zn, Cd, fecal strep, ammonia	bi-monthly Jan 1974 - Aug. 1974
Montana Dept. of Health & Environmental Sciences	--	Marias River at Tiber Dam	48°18'18"	111°04'41"	29N05E03BBB	pH, temp, cond, TDS, SAR, hardness, Ca, Mg, Na, HCO_3, CO_3, OH, Cl, SO_4, NO_3, F, total coliform, turbidity, As, Zn, Cd, BOD, Fe, Cu, Pb, PO_4	bi-monthly Sept. 1973 - Aug. 1974
Montana Dept. of Health & Environmental Sciences	--	Marias River near Loma	47°57'__"	110°32'__"	25N09E02DDB	pH, temp, cond, TDS, SAR, hardness, Ca, Mg, Na, K, HCO_3, CO_3, OH, Cl, SO_4, NO_3, F, total coliform, fecal coliform, total nonfilterable residue, Fe, Zn, Cd, As, Cu, Mn, PO_4, BOD	bi-monthly April 1974 - Aug. 1974
U. S. Geological Survey		Cut Bank Creek near Cut Bank				SiO_2, Fe, Ca, Mg, Na, K, HCO_3, SO_4, Cl, F, NO_3, TDS, hardness, % sodium, conductance, pH, phenols	monthly Nov. 1950 - Sept. 1951
U. S. Geological Survey	06__1852	Mission Lake near Blackfoot	48°33'48"	112°37'49"		temp, cond, pH, alkalinity, HCO_3, CO_3, total nitrogen, PO_4, hardness, Ca, Mg, Na, SAR, percent sodium, K, Cl, SO_4, F, SiO_2, Fe, Mn, TDS	every five weeks March 1971 - June 1972
U. S. Geological Survey	06__1853	Spring Creek near Cut Bank	48°33'27"	112°36'00"		temp, cond, pH, $CaCO_3$, HCO_3, CO_3, total nitrogen, PO_4, hardness, Ca, Mg, Na, SAR, percent sodium, K, Cl, SO_4, F, SiO_2, Fe, Mn, TDS	every ten days April 1971 - Oct. 1971
U. S. Geological Survey		Two Medicine Canal near Cut Bank	48°38'__"	112°30'__"	33N07W33___	SiO_2, Fe, Ca, Mg, Na, K, HCO_3, CO_3, SO_4, Cl, F, NO_3, B, TDS, hardness, percent sodium, SAR, cond, pH	weekly Aug. 1955 - Sept. 1955 May 1956 - Sept. 1956

LOCATION DESCRIPTIONS

Agency	Station Number	Location	Longitude	Latitude	Legal	Parameters	Period of Record
U. S. Geological Survey	06__1850	Two Medicine Canal wasteway near Cut Bank	48°32'40"	112°41'12"		temp, cond, pH, alkalinity, HCO_3, CO_3, total nitrogen, PO_4, hardness, Ca, Mg, Na, SAR, % sodium, K, Cl, SO_4, F, SiO_2, B, Fe, Mn, TDS	weekly May 1971 - Oct. 1971
U. S. Geological Survey		Badger Canal near Dupuyer	48°21'__"	112°34'__"	30N07W18___	SiO_2, Fe, Ca, Mg, Na, K, HCO_3, CO_3, SO_4, Cl, F, NO_3, B, TDS, hardness, % sodium, SAR, conductance, pH	weekly Aug. 1955 - Oct. 1955 May 1956 - Sept. 1956
U. S. Geological Survey		Two Medicine River near Browning				SiO_2, Fe, Ca, Mg, Na, K, HCO_3, SO_4, Cl, F, NO_3, B, TDS, hardness, percent sodium, SAR, conductance, pH	daily Aug. 1955 - Sept. 1956
U. S. Geological Survey		Priest Butte Lake drain near Choteau	47°47'__"	112°07'__"	23N04W04___	SiO_2, Fe, Ca, Mg, Na, K, HCO_3, CO_3, SO_4, Cl, F, NO_3, B, TDS, hardness, % sodium, SAR, conductance, pH, color	monthly Aug. 1955 - Oct. 1956
U. S. Geological Survey		Teton River near Choteau	47°47'__"	112°09'__"	23N04W05___	SiO_2, Fe, Ca, Mg, Na, K, HCO_3, CO_3, SO_4, Cl, F, NO_3, B, TDS, hardness, % sodium, SAR, cond, pH, color	monthly Aug. 1955 - Sept. 1956
U. S. Geological Survey		Teton River near Dutton				SiO_2, Fe, Ca, Mg, Na, K, HCO_3, SO_4, Cl, F, NO_3, B, TDS, hardness, percent sodium, SAR, pH, CO_3, color	daily Aug. 1954 - Sept. 1957
U. S. Geological Survey		Marias River near Shelby				pH, cond, SiO_2, Fe, Ca, Mg, Na, K, HCO_3, SO_4, Cl, F, NO_3, BO_3, TDS, hardness, % sodium, B,	monthly June 1947 - July 1947 Sept. 1949 - May 1953
U. S. Geological Survey		Marias River near Chester	48°19'__"	111°05'__"	30N05E33BAD	SiO_2, Fe, Ca, Mg, Na, K, HCO_3, CO_3, SO_4, Cl, F, NO_3, BO_3, TDS, hardness, SAR, cond, pH, color, temp, P, PO_4	daily Aug. 1964 - Sept. 1971
Montana Fish & Game		main body of Priest Butte Lake				Fe, Ca, Mg, Na, K. CO_3, HCO_3, SO_4, Cl, NO_3, PO_4, hardness, TDS, F	every two years Aug. 1959 - Jan. 1971

IX. WASTE DISCHARGE PERMITS

Six municipal and three agricultural waste discharge permits have been issued (August 22, 1974) by the state in the Marias basin (Table 22). Approximately ten additional permits for confined livestock operations are anticipated; probably no permits will be issued for irrigation projects.

The U. S. Environmental Protection Agency (EPA) also is issuing waste discharge permits in Montana. As of August 22, 1974 three NPDES permits (Table 23) have been issued for discharges in the Marias basin. The EPA issues permits only for discharges within the Blackfeet Indian Reservation. Federal permits are issued pursuant to the National Pollutant Discharge Elimination System (NDPES) created by the Federal Water Pollution Control Act Amendments of 1972 (FWPCAA of 1972). To eliminate the duplication of effort which formerly existed, Montana was given the authority to administer the NPDES program in Montana on June 10, 1974. Section 402 of the FWPCAA of 1972 provides that states with adequate water pollution control program elements may apply for and receive authority from the EPA to issue permits under the NPDES in their own states.

The Montana state program of issuing waste discharge permits is operated under authority of the Montana Water Pollution Control Law.*

*Statutory authority to apply and enforce state compliance schedules in state permits are Sections 69-4806(3), 4808.2(1)(f)(1) and (2), 69-4820, 69-4820.1 and 69-4823, Revised Codes of Montana, 1947. The applicable rule is existing MAC 16-2.14(10)-S14460, Montana Pollutant Discharge Elimination System (MPDES), Section (2)(b)(ii), effective March 8, 1974.

TABLE 22 MPDES PERMITS IN THE MARIAS BASIN

(current as of August 22, 1974)

Facility	MPDES Permit No.	Date Issued	Expiration Date	Compliance Schedule
Birch Cr Colony	pending; application not yet received or determined if needed			
Brady, MT lagoon		pending		
Chester, MT lagoon	MT-0020338	July 30, 1974	Dec. 31, 1976	date unspecified
Choteau, MT lagoon	MT-0020052	July 30, 1974	Dec. 31, 1976	date unspecified
Conrad, MT lagoon	MT-0020079	July 9, 1974	June 30, 1979	July 9, 1974(2)
Cut Bank, MT lagoon	MT-0020141	pending		
Dutton, MT lagoon	MT-0021598	Nov. 21, 1973	July 1, 1976	Nov. 21, 1973(2)
Inverness, MT lagoon	MT-0021644	no permit required		
Joplin, MT lagoon	MT-0021768	pending		
Kevin, MT lagoon	MT-0020842	no permit required		
Shelby, MT lagoon	MT-0020214	pending		
Valier, MT lagoon	MT-0021792	pending		
Cut Bank, MT water treatment plant				
clarifier (001):	MT-0000922	Feb. 25, 1974	Dec. 31, 1976	July 1, 1977(1)
filters (002):	MT-0000922	Feb. 25, 1974	Dec. 31, 1976	July 1, 1977(1)
Devon, MT water treatment plant		pending; application not yet received		
Big West Oil Refinery Kevin, MT		no permit required		
Westco Oil Refinery, Cut Bank, MT		pending; application not yet received		
Triangle Meat Packing Plant, Choteau, MT, lagoon		no permit required		

(1) Best Practicable Treatment by date specified.
(2) Discharge must meet secondary effluent requirements by date specified.
(3) Must provide 120 days waste storage by date specified.
(4) Must provide storage to contain overland flow through the confined animal operation from a 10-year, 24-hour storm.

Facility	MPDES Permit No.	Date Issued	Expiration Date	Compliance Schedule
Crary Ranch and Livestock, Choteau, MT		pending		
Fred Bergstrom, Brady, MT	MT-0029014	July 26, 1974	July 1, 1974	July 26, 1974(3)
Glacier Colony	pending; application not yet received or determined if needed			
Montana Sainfoin Feeders, Inc., Conrad, MT		pending		
New Rockport Colony		pending; application not yet received		
Rockport Colony		pending; application not yet received		
Russell Johnson, Cut Bank, MT	MT-0029009	July 3, 1974	June 1, 1979	July 3, 1974(3)
Spike D Cattle Com., Shelby, MT	F-7-B	June 5, 1973	June 5, 1978	June 5, 1973(4)

(1) Best Practicable Treatment by date specified.
(2) Discharge must meet secondary effluent requirements by date specified.
(3) Must provide 120 days waste storage by date specified.
(4) Must provide storage to contain overland flow through the confined animal operation from a 10-year, 24-hour storm.

TABLE 23 NDPES PERMITS IN THE MARIAS BASIN

(current as of August 22, 1974)

Facility	NPDES Permit No.	Date Issued	Expiration Date	Compliance Schedule
Blackfeet Boarding Dormitory, MT lagoon	MT-0020788	pending		July 1, 1977[1]
Browning, MT lagoon	MT-0023477	pending		Jan. 15, 1974[1]
Browning Industrial Sites, MT lagoon		no permit required		
East Glacier, MT lagoon	MT-0023108	pending		July 1, 1977[1]
East Glacier Lodge, MT lagoon	MT-0022659	permit not required		
Glendale Colony		pending; application not yet received		
Last Star Addition Browning, MT lagoon		no permit required		
Starr School, MT lagoon		no permit required		

[1]Discharge must meet secondary effluent requirements by date specified.

X. WASTE LOAD ALLOCATIONS

The Marias River from Cottonwood Creek to the Missouri River (a distance of about 40 miles) is not known to be suited to marginal propagation of salmonids, thus does not meet the B-D_2 Montana Water Quality Standards (Hill, 1974). Hill feels this is due to high temperatures. No point discharges occur in this segment, and effects of upstream discharges are eliminated in Tiber Reservoir; therefore, no waste load allocation has been made.

The Teton River from Spring Coulee (24N03W04) to Loma (a distance of about 115 miles) is water quality limited apparently due to high temperature. Investigation of a fish kill on the Teton River in August 1974 by the Water Quality Bureau revealed no trout present between Spring Coulee and Loma. Temperature is probably increased by decreased flows in the Teton River and its tributaries due to irrigation withdrawal as well as by the return of irrigation water to the river. The only point discharge to the river is from the Choteau sewage lagoon, a discharge that probably has a significant effect upon the stream's temperature when flows are low during the irrigation season. A more detailed investigation of the effects on the Teton River by the Choteau sewage lagoon and by the irrigation near Choteau is planned by the Water Quality Bureau.

Little Dry Coulee (about 4 miles long) north of Conrad is water quality limited due to high ammonia concentrations resulting from the Conrad sewage discharge. The discharge probably causes the Dry Fork of the Marias River to be water quality limited for an undetermined distance downstream. To correct this situation, ammonia reduction is needed for the Conrad sewage lagoons effluent.

Old Maid Coulee (about 2 miles long) near Cut Bank is probably water quality limited due to high ammonia concentrations resulting from the Cut Bank sewage discharge. Cut Bank is actively engaged in efforts to provide land disposal as a final step in sewage treatment; if land disposal is not feasible, ammonia reduction will be needed at the Cut Bank sewage lagoons.

Hilger Coulee north of Conrad is water quality limited due to high salinity from groundwater discharges. No point source discharges occur in this segment; therefore, no waste load allocation has been made.

Alkali Lake northwest of Valier is saline and is not suited for propagation of salmonids. This lake, therefore, is designated as water quality limited. The high salinity results from being an evaporation basin for a small drainage. No point source discharges occur in this segment; therefore, no waste load allocation has been made.

Priest Butte Lake near Choteau and all tributaries to Priest Butte Lake are not suited for propagation of salmonids, therefore, they are water quality limited. High salinity from groundwater discharges and from being an evaporation basin for an irrigation district are the causes of the salinity. No point source discharges occur in this segment; therefore, no waste load allocation has been made.

causes of the salinity. No point source discharges occur in this segment; therefore, no waste load allocation has been made.

Midvale Creek presently is not meeting Montana Water Quality Standards due to high fecal coliform concentrations from East Glacier Lodge downstream probably to its confluence with Two Medicine Creek. This segment will meet the water quality standards following the installation of secondary treatment for East Glacier and the East Glacier Lodge.

XI. MANAGEMENT AND STRATEGY PLAN

A water quality management strategy should be designed to maintain and enhance water quality in the basin and must consider requirements of all federal and state laws and regulations. The Federal Water Pollution Control Act Amendments of 1972 provide that for all discharges, other than publicly owned treatment works, not later than July 1, 1977, effluent limitations are to be achieved which represent application of best practicable control technology currently available. All publicly owned treatment works must achieve secondary treatment by July 1, 1977.

The Marias basin contains four percent of Montana's population or about 27,000 persons (1970 census). Eleven municipalities and one industry discharge wastes to streams within the basin. None of the dischargers are considered major dischargers.

From a basin strategy, management programs or plans can be developed and implemented. After plan development and implementation, water and wastes in the basin must be checked to determine the actual influence of the plan on basin waters. Water quality management is an iterative process; that is, a plan must be followed, the results checked and the program modified, and the results checked again. In the Marias basin, the basic strategy will consist of:

1. Permits will be used to regulate pollutant discharges.

2. Waste discharges will be monitored to ensure compliance with NPDES and MPDES permit conditions. Suspended residue, BOD_5, fecal coliforms, pH and flow will be monitored in all municipal discharges; residual chlorine will be measured where chlorination is provided. Municipal water treatment plant discharges will be monitored for aluminum, suspended residue, turbidity, flow, pH, and residual chlorine. Testing requirements for the Westco Refinery have not been established as of September 1, 1974. Discharges from confined livestock areas will not be allowed except under unusual conditions.* Monitoring of any discharge that occurs under these conditions involves recording the volume of discharge and the period of discharge. Monitoring of storm water discharges is not planned.

3. The Water Quality Bureau will participate with other regulatory agencies in controlling land use activities to abate pollution problems. Also, the Water Quality Bureau will

*Confined livestock areas must be capable of retaining the overland flow caused by a 10-year, 24-hour storm or, if protected from weather, they must have a facility that will hold the animals' waste for 120 consecutive days. Unusual conditions are a storm more severe than a 10-year, 24-hour storm or a bad winter making more than 120 days waste storage necessary.

participate with state and particularly local organizations in the Marias basin that have any other activities that can influence water quality.

4. Followup in-depth studies will be conducted on known or suspected pollution problems.

5. Selected water quality monitoring stations will be continued.

Authority to apply and enforce state compliance schedules in state permits is discussed under Section IX. Authority to enforce stream water quality standards is discussed in Appendix B.

XII. SURVEILLANCE PLAN

Water quality surveillance is the basic means for monitoring existing discharges for compliance with permit conditions, checking instream water quality against Montana's water quality standards and detecting long-term water quality changes in the basin. Upon completion of the Marias water quality inventory and management plan, a long-range water quality surveillance network will be maintained (Table 24). This will be in addition to present or proposed detailed studies of identified water quality problems (Sections VI and VIII).

The Water Quality Bureau will monitor municipal, industrial and agricultural discharges for compliance with state and federal permits. In addition, these same municipalities, industries and agricultural discharges will be required to monitor their own discharges. Conrad, Cut Bank and Shelby will be required to monitor monthly for BOD_5, total suspended solids, and fecal coliform and weekly for pH and flow. All other municipal dischargers in the Marias basin will be required to monitor quarterly for BOD_5, total suspended solids, fecal coliforms and pH, and monthly for flow. The only industrial self-monitoring that will be required will be for the Westco Refinery, and as of this date a permit and self-monitoring requirements have not been issued. The only self-monitoring required for agricultural discharges will be the monitoring of flow in case a discharge occurs; agricultural discharges should result only under extreme weather conditions which are essentially exclusive of the permit.

The Water Quality Bureau also will collect and analyze samples from basin discharges. Approximately 50 percent of the municipal discharges will be sampled yearly with the balance of samples in alternate years. The Water Quality Bureau will sample the Westco Refinery discharge annually.

Currently, the U. S. Geological Survey has established one permanent baseline station in the Marias basin. This is located at Mission Lake near Blackfoot and is described in Table 24. The Water Quality Bureau has established two permanent water quality monitoring stations in the Marias basin. These are Cut Bank Creek at the mouth and Pondera Creek near the mouth. Location and water quality parameters sampled at these sites is in Table 24. The station on Mission Lake has been established in order to continue to study the effect of water from the Two Medicine Canal on Mission Lake. The sampling station on Cut Bank Creek has been established due to the expected water quality change that should occur as sewage treatment improvements are realized at Cut Bank and Browning and as the waste discharges from the Cut Bank water treatment plant are eliminated. Possible degradation of Cut Bank Creek could occur should expansion of irrigation on the Seville Bench be realized or if saline seep continues to have an effect; also, oil fields and their related

activities are a constant possible source of temporary degradation. The water quality station established near the mouth of Pondera Creek should show a change in water quality that could result as the Tiber Water Users Association project begins and expands. It is possible that use of water through this association may increase flow in Pondera Creek and therefore change the quality of the stream.

TABLE 24-MARIAS WATER QUALITY SURVEILLANCE STATIONS

STATION NAME	AGENCY AND NUMBER	LOCATION(1)	SAMPLING INTERVAL	WATER QUALITY PARAMETERS
Mission Lake near Blackfoot	USGS 06091852	32N08W03B--	monthly April to October	Ca, Mg, Na, SO_4, Cl, HCO_3, CO_3, ortho PO_4, total N, PO_4, F, specific conductance, pH, residue, temperature, alkalinity, total hardness, non-carbonate hardness, SAR, percent Na, K, SiO_2, Fe, Mn, TDS
Cut Bank Creek at the mouth	WQB	32N05W34DAD	quarterly	Ca, Mg, Na, SO_4, Cl, HCO_3, CO_3, NO_3, F, PO_4, pH, temperature, flow, TDS, specific conductance, SAR, hardness, alkalinity, total coliform, fecal coliform, fecal strep, total phenol, total oil and grease, turbidity, DO, total recoverable Fe, Mn, Al, As, Zn, Cu, Cd, Pb
Pondera Creek near the mouth	WQB	29N05E15DBA	quarterly	Ca, Mg, Na, K, HCO_3, CO_3, Cl, SO_4, NO_3, F, PO_4, pH, flow, temperature, TDS, SAR, specific conductance, hardness, alkalinity, total coliform, fecal coliform, fecal strep, turbidity, DO, total recoverable Fe, Mn

(1) See Appendix C

XIII. MUNICIPAL FACILITIES INVESTMENTS

The Federal Water Pollution Control Act Amendments of 1972 set goals for municipal sewage treatment. Secondary treatment is to be achieved by July 1, 1977, best practicable treatment (BPT) by July 1, 1983 and no discharge of pollutants by 1985.

The EPA defines secondary treatment as:

Minimum BOD_5 (5-day biochemical oxygen demand) reduction - 85%
Minimum Suspended Solids reduction - 85%
Maximum BOD_5 in effluent, less than 30 mg/l, monthly average
less than 45 mg/l, weekly average
Maximum Suspended Solids in effluent, less than 30 mg/l, monthly average
less than 45 mg/l, weekly average
Fecal Coliform in effluent, less than 200 organisms/100 ml, mthly basis
less than 400 organisms/100 ml, wkly basis
pH must be maintained between 6 and 9 in effluent;

and BPT as: The best practicable control technology currently available for the 1977 target date. Secondary treatment is BPT for the Marias basin.

The term "no discharge of pollutants" has not been defined; however, it refers to wording in the 1972 amended Federal Water Pollution Control Act (Ref. 5) which calls for the elimination of pollutants into the navigable waters of the U. S. by 1985. Elimination of pollutants is stated as a goal and not as a rule. The wording could be defined as anything from no discharge (all land disposal) to best available treatment in 1985.

State water quality standards in the Marias basin will not be violated by any municipal discharges after the application of secondary treatment. Most towns plan to achieve no discharge of pollutants while upgrading to secondary treatment by using land disposal. Needs, projected costs and scheduling to reach secondary treatment are summarized in Table 25. Data to evaluate cost effectiveness of treatment needs was not available.

TABLE 25-MUNICIPAL SEWAGE TREATMENT NEEDS IN THE MARIAS BASIN

COMMUNITY	NEEDS DESCRIPTION	1990 DESIGN POPULATION	COST ESTIMATE	STATUS
Blackfoot Boarding Dormitory	(1) Infiltration study; upgrade lagoon to provide secondary treatment	(1) 280	(1) lagoon: $20,000 infiltration: $ 1,000 $21,000	not on priority list
Brady	(5) Upgrade lagoon to provide secondary treatment	(5) 215	not determined	should be funded in FY 76
Browning	(5) Upgrade lagoon to provide secondary treatment; infiltration problem, expand collection system	(5) 3,075	not determined	should be funded in FY 76
Chester	(1) Upgrade lagoon to provide secondary treatment; new interceptor, infiltration study	(1) 950	(1) lagoon: $80,000 infiltration: $ 1,000 sewer: $32,000 $113,000	should be funded in FY 76
Choteau	(1) Infiltration problem; upgrade lagoon to provide secondary treatment; expand collection system	(5) 2,630	not determined	not on priority list
Conrad	(1) Infiltration problem; upgrade and extend collection system	(1) 3,000	(1) infiltration: $53,000 sewers: $267,000 $320,000	low on priority list
Cut Bank	(5) Upgrade lagoon to provide secondary treatment; extend collection system	(5) 4,875	not determined	not on priority list

(1) Water Quality Bureau 1974 Needs Survey
(2) Montana Water Pollution Control Program Plan 1974
(3) John Beer (Amundson, Beer and Lund Engineers) conversation of August 6, 1974
(4) Mike Clasby (Four county - Glacier, Toole, Pondera, Teton - Sanitarian) conversation of Aug. 18, 1974
(5) Comprehensive Area-Wide Water and Sewer Plan 1970
(6) Water Quality Bureau Field Investigations 1974
(7) Water Quality Bureau estimate based on conversation with Robert Racine (Indian Health Service Sanitarian in Browning) on August 27, 1974

COMMUNITY	NEEDS DESCRIPTION	1990 DESIGN POPULATION	COST ESTIMATE	STATUS
Dupuyer	(5) Collection system; treatment facility	(5) 100	not determined	not on priority list
Dutton	(5) none	(5) 580	(5) $0	not on priority list
East Glacier Park	(3) Collection system extensions; provide secondary treatment	(5) 500	(3) lagoon: $ 70,000 sewers: $365,000 $435,000	has received a Step 1 Grant
Heart Butte	(5) Collection system; treatment facility	(5) 165	not determined	not on priority list
Inverness	(2) none	(5) 160	(2) $0	not on priority list
Joplin	(5) none	(5) 275	(5) $0	not on priority list
Kevin	(1) none	(1) 500	(1) $0	not on priority list
Laststar	(6) Upgrade lagoon to provide secondary treatment	(7) 500	not determined	not on priority list
Loma	(5) Collection system; treatment facility	(5) 140	not determined	not on priority list
Oilmont	(4) none	(5) 80	(4) $0	not on priority list
Santa Rita	(5) Collection system; treatment facility	(5) 90	not determined	not on priority list

(1) Water Quality Bureau 1974 Needs Survey
(2) Montana Water Pollution Control Program Plan 1974
(3) John Beer (Amundson, Beer and Lund Engineers) conversation of August 6, 1974
(4) Mike Clasby (Four county - Glacier, Toole, Pondera, Teton - Sanitarian) conversation of Aug. 18, 1974
(5) Comprehensive Area-Wide Water and Sewer Plan 1970
(6) Water Quality Bureau Field Investigations 1974
(7) Water Quality Bureau Estimate based on conversation with Robert Racine (Indian Health Service Sanitarian in Browning) on August 27, 1974

COMMUNITY	NEEDS DESCRIPTION	1990 DESIGN POPULATION	COST ESTIMATE	STATUS
Shelby	(5)Upgrade lagoon to provide secondary treatment; collection system extensions	(5)4,640	not determined	not on priority list
Starr School	(6)Upgrade lagoon to provide secondary treatment	(7)430	not determined	not on priority list
Valier	(1)Upgrade lagoon to provide secondary treatment; infiltration study	(1)600	(1)infiltration: $ 1,000 lagoon: $120,000 $121,000	should be funded in FY 76

(1) Water Quality Bureau 1974 Needs Survey
(2) Montana Water Pollution Control Plan 1974
(3) John Beer (Amundson, Beer and Lund Engineers) conversation of August 6, 1974
(4) Mike Clasby (Four county - Glacier, Toole, Pondera, Teton - Sanitarian) conversation of Aug. 18, 1974
(5) Comprehensive Area-Wide Water and Sewer Plan 1970
(6) Water Quality Bureau Field Investigations 1974
(7) Water Quality Bureau estimate based on conversation with Robert Racine (Indian Health Service Sanitarian in Browning) on August 27, 1974

XIV. APPENDIX

APPENDIX A

GLOSSARY

Symbol	Definition
SCS	U. S. Department of Agriculture, Soil Conservation Service
BR	U. S. Department of the Interior, Bureau of Reclamation
NPDES	National Pollutant Discharge Elimination System
WQB	Montana Department of Health and Environmental Sciences, Environmental Sciences Division, Water Quality Bureau
mgd	million gallons per day
BOD_5	five-day biochemical oxygen demand
gpd	gallons per day
tpd	tons per day
gpm	gallons per minute
mg/l	milligrams per liter
USGS	U. S. Geological Survey
cfs	cubic feet per second
JTU	Jackson Turbidity Units
μ	Micromhos per centimeter

Symbol	Definition
TR	Total recoverable
EPA	U. S. Environmental Protection Agency
$>$	greater than
$<$	less than
$\sim$	approximately
$\leq$	less than or equal to
F & G	Montana Department of Fish and Game
ml	milliliter
MPDES	Montana Pollutant Discharge Elimination System
BPT	Best Practicable Treatment
TOC	Total Organic Carbon

MONTANA STATE DEPARTMENT OF HEALTH
AND
ENVIRONMENTAL SCIENCES

MAC 16-2.14(10)-S14480 WATER QUALITY STANDARDS

(1) Policy statement. The following standards are adopted to establish maximum allowable changes in water quality and establish limits for pollutants which affect prescribed beneficial uses of state waters. The department adopts as a rule the policy that best practicable treatment and control of waste, activity and flow is to be provided to maintain dissolved oxygen and overall water quality at the highest possible levels, and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious substances at the lowest possible levels.

(2) Application of standards. The water quality standards are composed of water-use classifications [section (4)], water-use descriptions and specific water quality criteria [section (5)], and general water quality criteria [section (6)].

(a) General water quality criteria apply to all state waters except where in this rule specific water quality criteria are more applicable to a specific water-use classification.

(b) In order to carry out the objective of the rule, existing discharges to state waters shall be brought into compliance with the standards as soon as practicable, and in no case later than three years from the effective date of the rule.

(3) Definitions. Unless statutory definition or the context otherwise requires in this rule:

"Conduit" means any artificial or natural duct, either open or closed, for conveying liquids or other fluids.

"Dewatered stream" means a perennial or intermittent stream whose water has been removed for one or more beneficial uses.

"EPA" means the U. S. Environmental Protection Agency.

"Intermittent stream" means a stream or portion of a stream that flows only in direct response to precipitation; it receives little or no water from springs and no long-continued supply from melting snow or other sources.

"Naturally occurring" means conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Conditions resulting from dams in existence as of July 1, 1971 are natural.

"Mixing zone" means that volume of state water wherein any pollutant may exceed allowable water quality standards.

"Pesticide" means insecticides, herbicides, rodenticides, fungicides or any substance or mixture of substances intended for preventing, destroying, controlling, repelling, altering life processes, or mitigating any insects, rodents, nematodes, fungi, weeds and other forms of plant or animal life.

"Residue" means oils, floating solids and sludge deposits.

"Sediment" means solid material settled from suspension in a liquid; mineral or organic solid material that is being transported or has been moved from its site of origin by air, water or ice and has come to rest on the earth's surface, either above or below sea level; or inorganic or organic particles originating from weathering, chemical precipitation or biological activity.

"Settleable solids" means inorganic or organic particles that are being transported or have been transported by water from the site or sites of origin and are settled or are capable of being settled from suspension.

"Sewer" means a pipe or conduit that carries wastewater or drainage water.

"State waters" means any body of water, irrigation system or drainage system, either surface or underground. This section shall not apply to irrigation waters where the waters are used up within the irrigation system and said waters are not returned to any other state waters. The term "state waters" as used in this rule does not include underground water.

"Storm sewer" or "storm drain" means a sewer that carries storm water and surface water, street wash and other wash waters, or drainage but excludes sewage and industrial wastes.

"True color" means the color of water from which the turbidity has been removed.

"Turbidity" means a condition in water or wastewater caused by the presence of suspended matter resulting in the scattering and absorption of light rays.

(4) Water-use classifications.

COLUMBIA BASIN

Clark Fork River Drainage

Clark Fork River:

Warm Springs drainage to Myers Dam	A-Open-D_1
Remainder of Warm Springs drainage	B-D_1
Silver Bow Creek drainage to Anaconda Company leach dump	B-D_1
Silver Bow Creek (mainstem) from the confluence of Blacktail Deer Creek to Warm Springs Creek	E-F

Yankee Doodle Creek drainage to and including the Butte water supply reservoir . . . . . A-Closed

Remainder of Yankee Doodle Creek drainage to Anaconda Company tailings pond . . . . . B-D_1

Blacktail Deer Creek drainage except portion of Basin Creek listed below . . . . . B-D_1

Basin Creek drainage to and including the Butte water supply reservoir . . . . . A-Closed

Remainder of Basin Creek drainage . . . . . B-D_1

All other tributaries to Silver Bow Creek from the confluence of Blacktail Deer Creek to Warm Springs Creek . . . . . B-D_1

Clark Fork River (mainstem) from Warm Springs Creek to Cottonwood Creek . . . . . C-D_2

Clark Fork River (mainstem) from Cottonwood Creek to the Little Blackfoot River . . . . . C-D_1

Tin Cup Joe Creek drainage to the Deer Lodge water supply intake . . . . . A-Closed

Remainder of Tin Cup Joe drainage . . . . . B-D_1

Clark Fork River drainage from the Little Blackfoot River to the Idaho state line except those portions of tributaries listed below . . . . . B-D_1

Georgetown Lake and tributaries above Georgetown Dam . . . A-Open-D_1

Flint Creek drainage from Georgetown Dam to Farm-to-Market Highway No. 348 bridge about one mile west of Philipsburg except those portions of tributaries listed below . . . . . B-D_1

Fred Burr Lake and headwaters from source to the outlet of the lake . . . . . A-Closed

Flint Creek (mainstem) from Farm-to-Market Highway No. 348 bridge about one mile west of Philipsburg to the Clark Fork River . . . . . B-D_1

South Boulder Creek drainage to the Philipsburg water supply intake . . . . . A-Open-D_1

Remainder of South Boulder drainage . . . . . B-D_1

All other tributaries to Flint Creek from Farm-to-Market Highway No. 348 bridge to the Clark Fork River . . . . . B-D_1

Rattlesnake drainage to the Missoula water supply intake . . . . A-Closed

Remainder of Rattlesnake drainage . . . . . B-D_1

Packer and Silver Creek drainage (tributaries to the St. Regis River) to the Saltese water supply intake . . . . . A-Open-D_1

Remainder of Packer and Silver Creek drainages . . . . . B-D_1

Ashley Creek drainage to the Thompson Falls water supply intake A-Closed

Remainder of Ashley Creek drainage . . . . . B-D_1

Pilgrim Creek drainage to the Noxon water supply intake . . . . A-Open-D_1

Remainder of Pilgrim Creek drainage . . . . . B-D_1

All tributaries of Clark Fork River not otherwise mentioned . . B-D_1

Flathead River:

Flathead River drainage (except tributaries in Glacier National Park or in nationally designated wild, wilderness or primitive areas) except tributaries and lakes or reservoirs listed below . . . . . B-D_1

Essex Creek drainage to the Essex water supply intake . . . A-Closed

Remainder of Essex Creek drainage . . . . . B-D_1

Snyder Creek (mainstem) through the community of Lake McDonald in Glacier National Park to Lake McDonald . . . . B-D_1

Stillwater River (mainstem) from but excluding Logan Creek to the Flathead River . . . . . B-D_2

Whitefish Lake and its tributaries . . . . . A-Open-D_1

Whitefish River (mainstem) from the outlet of Whitefish Lake to the Stillwater River . . . . . B-D_2

Haskill Creek drainage to the Whitefish water supply intake . . A-Open-D_1

Remainder of Haskill Creek drainage . . . . . B-D_1

Remainder of Whitefish River drainage . . . . . B-D_1

Remainder of Stillwater River drainage . . . . . B-D_1

Ashley Creek drainage to and including Smith (Kila) Lake . . . . B-D_1

Ashley Creek (mainstem) from Smith Lake to bridge crossing on the airport road about one mile south of Kalispell . . . . . B-D_2

Ashley Creek (mainstem) from bridge crossing on airport road to the Flathead River . . . . . E-F

All tributaries to Ashley Creek from Smith Lake to the Flathead River . . . . . B-D_1

Flathead Lake and its tributaries except Flathead River above the lake (as listed above), Swan River and portions of Hellroaring Creek as listed below, but including Swan Lake proper and Lake Mary Ronan . . . . . A-Open-D_1

Swan River drainage (except Swan Lake proper) . . . . . B-D_1

Hellroaring Creek drainage to the Polson water supply intake . . . . . A-Closed

Remainder of Hellroaring Creek drainage . . . . . B-D_1

(Simply as a note for clarification, the Flathead River below the highway bridge at Polson to Paradise is included in the B-D_1 classification of the Flathead River drainage listed above.)

Crow Creek drainage to road crossing at Section 16, T20N, R20W about 2.5 miles southwest of Ronan except the portion of Second Creek listed below . . . . . B-D_1

Second Creek drainage to the Ronan water supply intake . . A-Closed

Remainder of Second Creek drainage . . . . . B-D_1

Crow Creek (mainstem) from road crossing in Section 16, T20N, R20W to the Flathead River . . . . . B-D_2

Tributaries to Crow Creek from road crossing in Section 16 to the Flathead River . . . . . B-D_1

Little Bitterroot River drainage to Hubbart Reservoir . . . . . B-D_1

Little Bitterroot River (mainstem) from Hubbart Reservoir dam to the Flathead River . . . . . B-D_2

Tributaries to the Little Bitterroot River from Hubbart Reservoir to the Flathead River except Hot Springs Creek listed below . . . . . B-D_1

Hot Springs Creek drainage to the Hot Springs water supply intake . . . . . A-Closed

Hot Springs Creek (mainstem) from the Hot Springs water supply intake to the Little Bitterroot River . . . . E-F

Tributaries to Hot Springs Creek (if any) from the Hot Springs water supply intake to the Little Bitterrot River . B-D_1

Mission Creek drainage to the St. Ignatius water supply intake . A-Open-D_1

Mission Creek drainage from the St. Ignatius water supply intake to U. S. Highway No. 93 crossing about one mile west of St. Ignatius . . . . . B-D_1

Mission Creek (mainstem) from U. S. Highway No. 93 crossing to the Flathead River . . . . . B-D_2

Tributaries to Mission Creek from the U. S. Highway No. 93 crossing to the Flathead River . . . . . B-D_1

Kootenai River:

Kootenai River drainage from the border of Canada to the Idaho border (including the Yaak River) except the tributaries listed below . . . . . B-D_1

Deep Creek drainage (tributary to the Tobacco River) to the Fortine water supply intake . . . . . A-Open-D_1

Sullivan Creek drainage to the Rexford water supply intake . . . A-Closed

Rainy Creek drainage to the Zonolite Company water supply intake . . . . . A-Open-D_1

Rainy Creek (mainstem) from the Zonolite Company water supply intake to the Kootenai River . . . . . C-D_1

Flower Creek drainage to the Libby water supply intake . . . . . A-Open-D_1

MISSOURI BASIN

Missouri River Drainage

Missouri River:

Missouri River drainage to the Sun River in Great Falls except tributaries listed below . . . . . B-D_1

East Gallatin River (mainstem) (tributary to the Gallatin River, tributary to the Missouri River) from Montana Highway No. 293 crossing about one-half mile north of Bozeman to but excluding Dry Creek about five miles east of Manhattan . . . B-D_2

Remainder of East Gallatin River drainage except the tributaries listed below . . . . . B-D_1

Lyman and Sourdough (Bozeman) Creek drainages to the Bozeman water supply intake . . . . . A-Closed

Remainder of the Lyman and Sourdough Creek drainages . . . B-D_1

Hyalite Creek drainage to the Bozeman water supply intake . A-Open-D_1

Remainder of Hyalite Creek drainage . . . . . B-D_1

Big Hole River drainage (tributary to the Jefferson River, tributary to the Missouri River) above Divide . . . . . A-Open-D_1

Remainder of the Big Hole drainage . . . . . B-D_1

Rattlesnake Creek drainage (tributary to the Beaverhead River, tributary to the Jefferson River) to the Dillon water supply intake . . . . . A-Open-D_1

Remainder of Rattlesnake Creek drainage . . . . . B-D_1

Indian Creek drainage (tributary to the Ruby River, tributary to the Beaverhead River) to the Sheridan water supply intake . . A-Open-D_1

Remainder of Indian Creek drainage . . . . . B-D_1

Basin Creek drainage (tributary to the Boulder River, tributary to the Jefferson River) to the Basin water supply intake . . . . . A-Open-D_1

Remainder of Basin Creek drainage . . . . . B-D_1

Prickly Pear Creek drainage to the Montana Highway No. 433 crossing about one mile northwest of East Helena except the tributaries listed below . . . . . B-D_1

McClellan Creek drainage to the East Helena water supply intake . . . . . A-Open-D_1

Remainder of McClellan Creek drainage . . . . . B-D_1

Prickly Pear Creek (mainstem) from the Montana Highway No. 433 crossing about one mile northwest of East Helena to Lake Helena . . . . . E-F

Tributaries of Prickly Pear Creek from the Montana Highway No. 433 crossing to its mouth except those tributaries listed below . . . . . B-D_1

Ten Mile Creek drainage to the Helena water supply intake . A-Open-D_1

Remainder of Ten Mile Creek drainage . . . . . B-D_1

Willow Creek drainage (tributary of the Smith River, tributary to the Missouri River) to the White Sulphur Springs water supply intake . . . . . A-Closed

Remainder of the Willow Creek drainage . . . . . B-D_1

Missouri River (mainstem) from Sun River to Rainbow Dam . . . . B-D_2

Missouri River drainage from Rainbow Dam in Great Falls to the North Dakota state line except the portion of the mainstem and the tributaries listed below . . . . . B-D_3

Sun River drainage to but excluding Muddy Creek near Vaughn . . . . . B-D_1

Muddy Creek drainage . . . . . E-F

Sun River (mainstem) from Muddy Creek to the Missouri River . . . . . B-D_3

Tributaries (if any) to the Sun River from Muddy Creek to the Missouri River . . . . . B-D_1

Belt Creek drainage to and including Otter Creek except portion of O'Brien Creek listed below . . . . . B-D_1

O'Brien Creek drainage to the Neihart water supply intake . . . . . A-Open-D_1

Remainder of O'Brien Creek drainage . . . . . B-D_1

Belt Creek (mainstem) from Otter Creek to the Missouri River . . . . . B-D_2

Tributaries to Belt Creek from Otter Creek to the Missouri River . . . . . B-D_1

Highwood and Shonkin Creek drainages B-D1

Marias River drainage except the tributaries listed below . . . B-D2

Cutbank Creek drainage to but excluding Old Maid Miller Coulee in Cut Bank except the portion of Willow Creek listed below . . . . . B-D_1

Willow Creek drainage to the Montana Highway No. 464 crossing about one-half mile north of Browning . . . . B-D_1

Willow Creek (mainstem) from the Montana Highway No. 464 crossing to Cutbank Creek (also included in the Marias River drainage classification above) . . . . . B-D_2

Tributaries (if any) to Willow Creek from Montana Highway No. 464 crossing to Cutbank Creek . . . . . B-D_1

Cutbank Creek (mainstem) from Old Maid Miller Coulee to Birch Creek (also listed under Marias River drainage classification above) B-D2

Tributaries to Cutbank Creek from but excluding Old Maid Miller Coulee (which is B-D2) to Birch Creek B-D1

Birch Creek drainage except tributaries listed below . . . B-D2

Two Medicine Creek drainage to and including the Badger Creek drainage B-D1

Midvale Creek drainage to the East Glacier water supply intake . . . . . A-Closed

Remainder of Midvale Creek drainage B-D1

Summit Creek drainage to the Summit water supply intake . . . . . A-Closed

Remainder of Summit Creek drainage B-D1

Two Medicine Creek (mainstem) from Badger Creek to Birch Creek B-D2

Tributaries to Two Medicine Creek from Badger Creek to Cutbank Creek B-D1

Teton River drainage to and including Deep Creek near Choteau B-D1

Remainder of Teton River drainage B-D2

Eagle Creek drainage to but excluding Dog Creek B-D1

Remainder of Eagle Creek drainage B-D3

Judith River drainage to Big Spring Creek B-D1

Big Spring Creek drainage to the Mill Ditch headgate near the southern city limits of Lewistown B-D1

Big Spring Creek (mainstem) from the Mill Ditch headgate to the Judith River B-D2

Tributaries to Big Spring Creek from the Mill Ditch headgate to the Judith River B-D1

Judith River (mainstem) from Big Spring Creek to the Missouri River B-D2

Tributaries to the Judith River from Big Spring Creek to the Missouri River B-D1

Cow Creek drainage to but excluding Al's Creek B-D1

Remainder of Cow Creek drainage B-D3

Musselshell River drainage to and including Hopley Creek near Harlowton B-D1

Musselshell River drainage from Hopley Creek to but excluding Half Breed Creek near Roundup except American Fork listed below B-D2

American Fork drainage B-D1

Musselshell River drainage from and including Half Breed Creek to Fort Peck Reservoir except Flatwillow Creek drainage listed below B-D3

Flatwillow Creek drainage (may be the Box Elder Creek drainage) near Mosby B-D2

Missouri River (mainstem) from Fort Peck Dam to the Milk River B-D2

Milk River drainage from source (or from the Glacier National Park Boundary) to the International Boundary B-D1

Milk River drainage from the International Boundary to the Missouri River except the tributaries listed below B-D3

Big Sandy Creek drainage above Big Sandy B-D1

Remainder of Big Sandy Creek drainage B-D3

Beaver, Box Elder and Clear Creek drainages (all near Havre) B-D1

People's Creek drainage to and including the South Fork of People's Creek B-D1

Remainder of People's Creek drainage B-D3

Wolf Creek drainage near Wolf Point B-D2

Poplar River drainage B-D2

Yellowstone River:

Yellowstone River drainage from the Yellowstone Park Boundary to the Laurel water supply intake B-D1

Yellowstone River drainage from the Laurel water supply intake to the Billings water supply intake except the tributaries listed below B-D2

Clarks Fork River drainage from source to the Wyoming state line and from the Wyoming state line to and including Jack Creek near Bridger . . . . . B-D_1

Clarks Fork River (mainstem) from Jack Creek to the Yellowstone River . . . . . B-D_2

Tributaries to the Clarks Fork River from Jack Creek to the Yellowstone River except the West Fork of Rock Creek listed below . . . . . B-D_1

West Fork of Rock Creek drainage to the Red Lodge water supply intake . . . . . A-Open-D_1

Remainder of West Fork of Rock Creek drainage . . . . B-D_1

Yellowstone River drainage from the Billings water supply intake to the North Dakota state line except the tributaries listed below . . . . . B-D_3

Pryor Creek drainage . . . . . B-D_1

Big Horn drainage above but excluding William's Coulee near Hardin . . . . . B-D_1

Big Horn drainage from and including William's Coulee to the Yellowstone River except the Little Big Horn listed below . . . . . B-D_2

Little Big Horn drainage above and including Lodgegrass Creek near Lodge Grass . . . . . B-D_1

Remainder of the Little Big Horn drainage . . . . B-D_2

Tongue River (mainstem) from Tongue River Reservoir to but excluding Prairie Dog Coulee . . . . . B-D_2

Remainder of the Tongue River drainage . . . . . B-D_3

Fox Creek drainage near Sidney . . . . . B-D_2

Little Missouri and Belle Fourche drainages - all waters . . . . . B-D_3

Hudson Bay drainage:

All waters within Glacier National Park except the portion of Swiftcurrent Creek listed below . . . . . A-Open-D_1

Swiftcurrent Creek (mainstem) from the Many Glacier Chalet to Lake Sherbourne . . . . . B-D_1

All waters outside park from park boundary to the International Boundary . . . . . B-D_1

(5) Water-use description and specific water quality criteria.

(a) General. Specific water quality criteria, along with criteria in section (6) protect the beneficial water uses set forth in the water-use descriptions for the following classifications of water. Criteria for organisms of the coliform group are based on a minimum of five samples obtained during separate 24-hour periods during any consecutive 30-day period analyzed by the most probable number or equivalent membrane filter methods. The metal limits on the Clark Fork River [section (6)] are to govern when this section (5) imposes a conflicting requirement with that criteria.

(b) A-Closed classification.

(i) Water-use description. Water supply for drinking, culinary and food processing purposes suitable for use after simple disinfection. Public access and activities such as livestock grazing and timber harvest are to be controlled by the utility owner under conditions prescribed and orders issued by the department. Only those waters on which access is presently controlled by the utility owner have been classified as A-Closed. If other uses are permitted, the waters are to be reclassified A-Open-D_1.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the coliform group is not to exceed 50 per 100 milliliters.

(ab) Dissolved oxygen criteria are not applicable for the classification.

(ac) No change from natural pH is allowed.

(ad) No increase above naturally occurring turbidity is allowed.

(ae) No increase above naturally occurring water temperature is allowed.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) No increases of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, above naturally occurring concentrations, are allowed.

(ah) No wastes are allowed which increase radioactivity above natural background levels.

(c) A-Open-D_1 classification.

(i) Water-use description. Water supply for drinking, culinary and food processing purposes suitable for use after simple disinfection and removal of naturally present impurities. Water quality is to be maintained suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. Where the waters are used for swimming or other water-contact sports, analyses are to be made by the utility owner and the department to determine if a higher degree of treatment is required for potable water use.

Waters, if shown to meet the A-Closed criteria, may be so classified by the department at the request of the utility owner. State waters within the boundaries of national parks and nationally designated wild, wilderness or primitive areas in the state are classified A-Open-D_1 except those adjacent to developed areas such as Snyder Creek through the community of Lake McDonald and Swiftcurrent Creek below the Many Glacier Chalet, both in Glacier National Park. Also, Georgetown, Flathead and Whitefish lakes and Lake Mary Ronan are classified A-Open-D_1 as are some streams presently used for domestic water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the coliform group is not to exceed 50 per 100 milliliters where demonstrated to be the result of domestic sewage.

(ab) Dissolved oxygen concentration is not to be reduced below 7.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 is to be maintained above 7.0.

(ad) No increase above naturally occurring turbidity is allowed.

(ae) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits established in the 1962 U. S. Public Health Service Drinking Water Standards or subsequent editions; an increase of more than 10 percent of the concentration present in the receiving water is not allowed; maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than two units above naturally occurring color.

(d) B-D1 classification.

(i) Water-use description. The quality is to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters, nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters, nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 7.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 is to be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 5 Jackson Candle Units except as is permitted in the general water quality criteria.

(ae) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

This applies to all waters in the state classified B-D_1 except for Prickly Pear Creek from McClellan Creek to the Montana Highway No. 433 crossing where a 2° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 65° F; within the naturally occurring range of 65° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U. S. Public Health Service Drinking Water Standards or subsequent editions; no increase of more than 10 percent of the concentration present in the receiving water is permitted; maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

(e) B-D_2 classification.

(i) Water-use description. The quality is to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 7.0 milligrams per liter from October 1 through June 1 nor below 6.0 milligrams per liter from June 2 through September 30.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 is to be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 10 Jackson Candle Units, except as is permitted in the general water quality criteria.

(ae) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U. S. Public Health Service Drinking Water Standards or subsequent editions, and no increase of more than 10 percent of the concentration present in the receiving water is permitted; maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

(f) B-D3 classification.

(i) Water-use description. The quality is to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 5.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 shall be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 10 Jackson Candle Units, except as is permitted in the general water quality criteria.

(ae) A 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 77° F; within the naturally occurring range of 77° F to 79.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 80° F; and where the naturally occurring water temperature is 79.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

This applies to all waters in the state classified B-D3, except from the Billings water supply intake to the water diversion at Intake, a 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 79° F; within the range of 79° F to 81.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 82° F; and where the naturally occurring water temperature is 81.5° F or greater, the maximum allowable increase in water temperature is 0.5° F.

From the water diversion at Intake to the North Dakota state line, a 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 82° F; within the range of 82° F to 84.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 85° F; and where the naturally occurring water temperature is 84.5° F or greater, the maximum allowable increase in water temperature is 0.5° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U. S. Public Health Service Drinking Water Standards or subsequent editions, and no increase of more than 10 percent of the concentration present in the receiving water is permitted; maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

(g) C-D1 classification.

(i) Water-use description. The quality is to be maintained suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 7.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 is to be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 5 Jackson Candle Units, except as is permitted in the general water quality criteria.

(ae) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, are not to exceed levels known or demonstrated to be of public health significance; also maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

(h) C-D2 classification.

(i) Water-use description. The quality is to be maintained for bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 7.0 milligrams per liter from October 1 through June 1 nor below 6.0 milligrams per liter from June 2 through September 30.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 is to be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 10 Jackson Candle Units, except as is permitted in the general water quality criteria.

(ae) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, are not to exceed levels known or demonstrated to be of public health significance; also maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

(d) E-F classification.

(i) Water-use description. The quality is to be maintained for agricultural and industrial water uses other than food processing.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 3 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.5 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 is to be maintained above 7.0.

(ad) Naturally occurring turbidity, naturally occurring water temperatures and naturally occurring concentrations of sediments, settleable solids or residues are not to be increased in quantity or amounts which adversely affect the use indicated.

(ae) Concentrations of toxic or deleterious substances, pesticides and organic and inorganic materials including heavy metals, are to be less than those demonstrated to be deleterious to livestock or plants or their subsequent consumption by humans or to adversely affect other indicated uses.

(6) General water quality criteria.

(a) The degree of waste treatment required to restore and maintain the standards is to be determined by the department and is to be based on the following.

(i) The state's policy of nondegradation of existing high water quality as described in Section 49-4808.2, R.C.M. 1947.

(ii) Present and anticipated beneficial uses of the receiving water.

(iii) The quality and nature of flow of the receiving water.

(iv) The quantity and quality of the sewage, industrial waste or other waste to be treated.

(v) The presence or absence of other sources of pollution on the same watershed.

(b) Sewage is to receive a minimum of secondary treatment as defined by EPA in accordance with requirements set forth in the Federal Water Pollution Control Act Amendments of 1972.

(c) Industrial waste is to receive, after maximum practicable in-plant control a minimum of secondary treatment or equivalent (reduction of suspended solids and organic materials where present in significant quantities, effective disinfection where bacterial organisms of public health concern are present, and control of toxic or other deleterious substances) before discharge into state waters.

(d) For design of disposal systems, stream flow dilution requirements are to be based on minimum consecutive seven-day average flow which may be

expected to occur on the average of once in ten years. When dilution flows are less than the above design flow at a point discharge, the discharge is to be governed by the permit conditions developed for the discharge through the waste discharge permit program.

(e) State surface waters are to be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will:

(i) Settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines.

(ii) Create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials.

(iii) Produce odors, colors or other conditions as to create a nuisance or render undesirable tastes to fish flesh or make fish inedible.

(iv) Create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life.

(v) Create conditions which produce undesirable aquatic life.

(f) No wastes are to be discharged and no activities conducted such that the wastes or activities, either alone or in combination with other wastes or activities, will violate, or can reasonably be expected to violate, any of the standards; (e.g., in a reach of stream classified B-D_1, the total allowable cumulative increase to naturally occurring turbidity conditions in the reach is 5 Jackson Candle Units).

(g) No wastes are to be discharged and no activities conducted which, either alone or in combination with other wastes or activities, will cause turbidities to exceed those allowed by specific water quality criteria; provided, short-term activities necessary to accommodate essential dredging, channel or bank alterations, stream diversions or other construction where turbidities in excess of the criteria are unavoidable, may be authorized by the department under conditions as it may prescribe.

(h) Methods of sample collection, preservation and analysis used to determine compliance with the standards are to be in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association or in accordance with tests or procedures that have been found to be equally or more applicable.

(i) For operations of existing water impoundments that cause conditions harmful to prescribed beneficial uses of state waters, it is to be

demonstrated to the satisfaction of the department that continued operations will be done in the best practicable manner to minimize harmful effects and will not violate state laws or department rules. New water impoundments shall be designed to provide temperature variations in discharging water that maintain or enhance the existing propagating fishery and associated aquatic life. As a guide, the following temperature variations are recommended: Continuously less than 40° F during the months of January and February, and continuously greater than 44° F during the months of June through September.

(j) Ponds for waste treatment purposes are not to be located in drainage ways where the volume of drainage water from a 10-year storm entering the ponds exceeds one-half the volume of the pond; provided that, subject to approval by the department as to design and maintenance, ponds located in drainage ways for the express purpose of containing emergency oil spills are permitted.

(k) Dumping of snow from municipal and/or parking lot snow removal activities into waters of the state is prohibited without a permit from the department.

(l) Existing discharges to state waters will be entitled a mixing zone as determined by the department.

(m) Until such time as minimum stream flows are established for dewatered streams, the minimum treatment requirements for discharges to dewatered receiving streams are to be no less than the minimum treatment requirements prescribed.

(n) Treatment requirements for discharges to intermittent streams are to be no less than the minimum treatment requirements prescribed.

(o) Pollution resulting from storm drainage, storm sewer discharges, and non-point sources, including irrigation practices, road building, construction, logging practices, overgrazing and other practices, are to be eliminated or minimized as ordered by the department.

(p) Application of pesticides in or adjacent to state waters is to be in compliance with the labeled direction, and in accordance with provisions of the Montana Pesticides Act (Title 27, Chapter 2, R.C.M. 1947) and the Federal Environmental Pesticides Control Act (Public Law 92-516). Excess pesticides and pesticide containers are not to be disposed of in a manner or in a location where they are likely to pollute state waters.

(q) The following radiological criteria shall apply to all waters except those classified as A-Closed:

(i) The average dissolved concentrations (including the naturally occurring or background contribution) of iodine 131, radium-226, strontium-89, strontium-90 and tritium are not to exceed the following concentration limits:

Iodine-131	5 pCi/L
Radium-226	1 pCi/L
Strontium-89	100 pCi/L
Strontium-90	10 pCi/L
Tritium	3,000 pCi/L

For all other radionuclides, the average dissolved concentration limits are to be 1/150 of the corresponding maximum permissible concentration in water for continuous occupational exposure as recommended by the National Committee on Radiation Protection (National Bureau of Standards Handbook 69 or subsequent revisions.)

(ii) For a mixture of radionuclides, the following relationship is to be satisfied:

$$\frac{C_1}{L_1} + \frac{C_2}{L_2} \ldots + \frac{C_n}{L_n} \leq 1.00$$

C denotes the average concentration of the respective radionuclide, and L denotes its concentration limit.

(iii) Where alpha emitters, strontium-90, radium-228, iodine-129, iodine-130 and lead-210 are known to be absent, routine analyses for dissolved gross beta radioactivity (excluding potassium-40 contribution) may be employed to monitor and show compliance with this criterion (except for tritium) as long as the gross concentration does not exceed 100 pCi/L. When these conditions are not met, routine quantitative analyses of individual radionuclides are to be performed to show compliance. Except in cases where tritium from other than natural sources is known to be absent, routine tritium analyses are to be performed to show compliance. (Note: "Absence" means a negligibly small fraction of the specific concentration limit, where the limit for unidentified alpha emitters is taken as the limit for radium-226.)

(iv) For radionuclides associated with suspended material in transport, the average concentration limits are to be 1/150 of the corresponding maximum permissible concentration in water (insoluble form) for continuous occupational exposure as recommended by the National Committee on Radiation Protection. In-stream sedimentation of these materials is not to produce solids beds that are not in compliance with subsections (q) (i) and (q) (ii) (because of leaching) and/or excessive accumulation in native flora and fauna.

(v) Average concentrations are to be computed from monitoring data acquired during the previous 12 months; maximum concentrations are not to exceed three times the average concentration limits specified.

(vi) Variances from concentration limits specified will be permitted only if the contributing source is non-controllable or a natural source. Best available treatment must be provided for man-made discharges, and the exposure received by affected population groups must be within established dose limits.

(r) No wastes are to be discharged and no activities conducted which, either alone or in combination with other wastes or activities, will result in the dissolved gas content relative to the water surface to exceed 110 percent of saturation.

(s) Bioassay median tolerance concentrations are to be based on latest available research results for the materials, by bioassay tests procedures for simulating actual stream conditions as set forth in the latest edition of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association, or in accordance with tests or analytical procedures that have been found to be equal or more applicable by EPA. Bioassay studies are to be made using the most sensitive local species and life stages of economic or ecological importance; provided other species whose relative sensitivity is known may be used when there is difficulty in providing the most sensitive species in sufficient numbers.

When specific application factors are not available, the factor is to be determined by using methods listed in Water Quality Criteria published by the Federal Water Pollution Control Administration (1968), or by using other methods accepted as equal or applicable by EPA.

(t) Metal limits for the Clark Fork River (mainstem) from the confluence of Warm Springs Creek to the confluence with Cottonwood Creek are:

Material	Average Daily Concentration ug/l	Maximum Instantaneous Concentration ug/l
Total copper	90	180
Dissolved copper	30	40
Total zinc	300	1,000
Dissolved zinc	80	140
Total iron	1,300	2,200
Dissolved iron	150	160
Total lead	100	100
Dissolved lead	100	100
Total cadmium	10	10
Total arsenic	10	16
Total mercury	1	1

Metal limits for Clark Fork River (mainstem) from the confluence of Cottonwood Creek to the Idaho state line are:

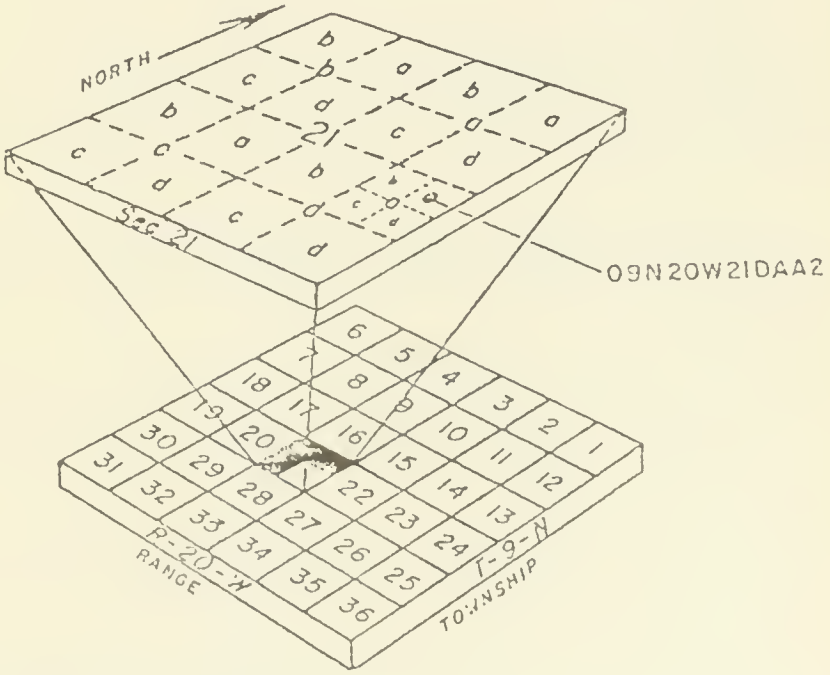
Material	Average Daily Concentration ug/l	Maximum Instantaneous Concentration ug/l
Total copper	50	90
Dissolved copper	30	30
Total zinc	100	200
Dissolved zinc	70	80
Total iron	300	1,300
Dissolved iron	150	150
Total lead	50	50
Dissolved lead	50	50
Total cadmium	10	10
Total arsenic	10	10
Total mercury	1	1

(History: Sec. 69-4814, R.C.M. 1947; AMD, Order MAC No. 16-2-5; Adp. 7/13/73; Eff. 11/5/73; MAC Not. No. 16-2-3; PRIOR P. 16-375 through 16-394.)

APPENDIX C

SYSTEM FOR GEOGRAPHIC LOCATION OF FEATURES

Wells, springs, water-sampling locations, and stream-gaging locations are assigned numbers based on the system of land subdivision used by the U. S. Bureau of Land Management. The number consists of twelve characters and describes the location by township, range, section, and position within the section. The figure below illustrates the numbering method. The first three characters of the number give the township, the next three characters the range. The next two numbers give the section number within the township, and the next three letters describe the location within the quarter section (160-acre tract) and the quarter-quarter section (40-acre tract), and the quarter-quarter-quarter section (10-acre tract). These subdivisions of the 640-acre section are designated a, b, c, and d in a counterclockwise direction, beginning in the northeast quadrant. If there is more than one feature in a 10-acre tract, consecutive digits beginning with 2 are added to the number. For example, if a water-quality sample was collected in sec.21,T.9N.,R20W, it would be numbered 09N20W21DAA2. The letters DAA indicate that the well is in the NE¼ of the NE¼ of the SE¼, and the number 2 following the letters DAA indicates there is more than one water-quality sampling location in this 10-acre tract.



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